SRI International

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EVALUATION OF THE RESEARCH EXPERIENCES FOR TEACHERS (RET) PROGRAM: 2001-2005

Final Report

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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[1] 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 4 weeks during the summer, with "sustained follow-up" over the course of the subsequent academic year. RET also funds several week-long teacher workshops.

There are two mechanisms of RET support: RET Supplements and RET 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 RET 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 two online surveys, one in the summer and fall of 2004, and one in the spring of 2006. The 2004 survey population included 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 results reported here are based on the 631 responses from the two surveys combined.

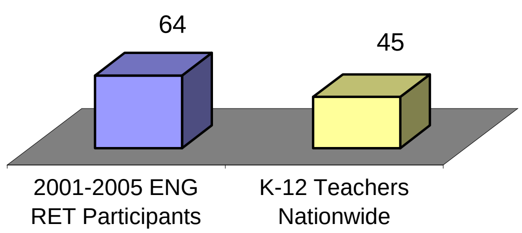
[1] The program encourages the participation of both inservice and preservice (education majors who are still pursuing their degrees) teachers. In FY 2001 and FY 2002, the program included only K-12 teachers; in FY 2003, community college faculty were added to the target audience.

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[2] 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.

Percentages of 2001-2005 ENG RET Participants and K-12 Teachers Nationwide Who Have a Master's Degree

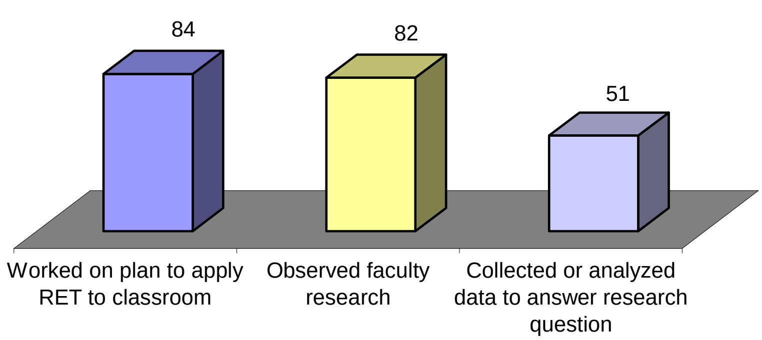


Sources: SRI International RET surveys, 2004 and 2006; 1999-2000 Schools and Staffing Survey, National Center for Education Statistics.

Participants Tended to Be Well-Qualified Teachers

All but 4% of ENG RET participants were teachers immediately before participating in RET, and 91% 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.

Percentage of 2001-2005 ENG RET Participants Who Did Each Activity



Sources: SRI International RET surveys, 2004 and 2006;

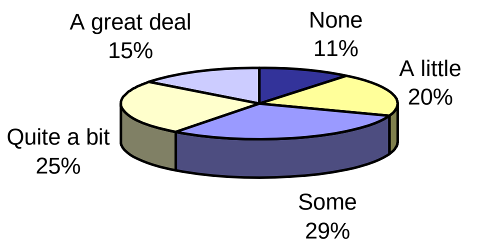
For Most, Focus Was on Relating Research to K-12 Classroom Subjects, Rather Than on Research *Per Se*

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, about 8 in 10 worked on classroom plans and observed faculty research activities, but only 5 in 10 collected or analyzed data to try to answer a research question. By comparison, 86% of undergraduates in 2003 REU projects collected or analyzed data.[3]

[2] 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.

[3] 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.

Amount of RET Follow-up Interaction Reported by 2001-2005 ENG RET Participants



Sources: SRI International RET surveys, 2004 and 2006.

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

RET Program announcements for FY 2002 and FY 2003 indicated that follow-up should be a central element of the Program activities. In fact, the surveys suggested that follow-up typically played a relatively tangential role. About a third of respondents said there was only a little follow-up interaction during the academic year following their RET project, or none at all—twice as many as said there was a great deal of follow-up.

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: 78% 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, only slightly over half 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-six 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 more than three-fourths, 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 awareness of current STEM research issues	89
Increased my confidence in my ability as a STEM teacher generally	89
Increased my professional opportunities	83
Included examples or applications from my RET activities in my teaching	82
Tell students more about or use more new technologies	82
Increased my understanding of STEM applications in everyday life	80

Over 80% of respondents also reported positive effects on their students. Most common were students' increased awareness of STEM career options (56%), more positive attitudes about STEM subjects in general (52%), and greater interest in the respondents' classes (47%).

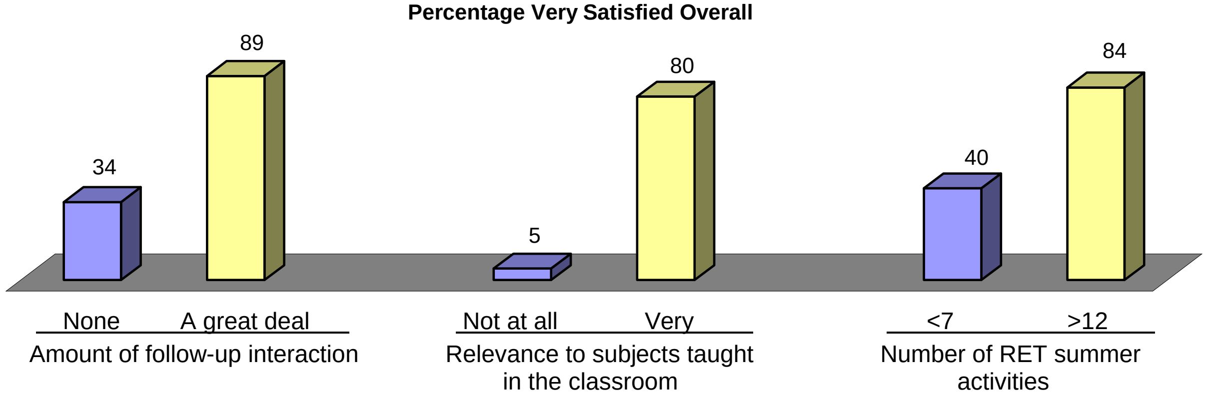
Ongoing Collaborative Relationships Appeared to Be Rare

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 teachers of science and mathematics and the NSF research community did not appear to have gained much traction. Few teachers (19%) participated in the RET program for more than 1 year, and most were the only individual from their school to have participated; a mere 3% reported that as many as four individuals from their school had participated.

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

Among participants who currently teach, about 6 in 10 reported that, overall, the RET activities were "very relevant" to the subjects they currently teach, a third 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, 89% of those who reported a great deal of follow-up interaction were very satisfied overall with their RET experiences, compared with only 34% of those who reported no follow-up interaction.

Relationship Between Satisfaction and Follow-up, Relevance to Subjects Taught, and Number of RET Summer Activities: Percentage Very Satisfied Overall



Sources: SRI International RET surveys, 2004 and 2006.

High Cost of Materials and Equipment Has Declined Somewhat as an Obstacle to Transferring RET Knowledge to the Classroom

The 2004 survey found that, by a considerable margin, the high cost of materials and equipment was overall the biggest obstacle, rated as a major obstacle by 43% of respondents and as a minor obstacle by another 31%. Encouragingly, the 2006 survey found that although this was still the most common obstacle, the percentages who experienced this and other implementation problems declined since the early days of the Program. In particular, the percentage who reported materials and equipment cost to be a major obstacle declined 15 percentage points, from 44% in 2004 to 29% in 2006.

Participants Gave Wide Variety of Suggestions for Program/Project Improvement

Participants' suggestions covered such issues as project organization, consultation with the teachers themselves, mentor support, project follow-up, and expanded participation opportunities. For example:

> *Would help if they would ask what area of research we might be interested in.*
>
> *The orientation session should include a syllabus of some sort, scheduling out activities for specific days and setting clear goals.*
>
> *Participants need to have year-round contact with professors/mentors and access to facilities.*
>
> *Let us participate more in the lab. The PIs seriously underestimate the abilities and intellectual capabilities of some teachers.*
>
> *The program would have a much higher quality if only professors who were truly committed to mentoring participated.*
>
> *I think this would be an excellent program for high school students as well, and I would love to hear more about opportunities for teachers and high school students.*

OVERVIEW AND RECOMMENDATIONS

A large majority of 2001-2005 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. This being said, there remain several opportunities for enhancement. Below is a summary of SRI's major suggestions for achieving this end.

- Require that proposals describe a follow-up plan involving ongoing interaction that supports classroom implementation of lesson plans, curricula, or skills developed in the RET project. Also, encourage renewal proposals to provide documentation of such follow-up in previous years.
- RET projects should be limited to participants whose classroom subjects are directly related to the RET experiences.
- Encourage PIs to include a variety of activities in the summer projects but at the same time to maintain a focus on activities that are relevant to the participants' ultimate need to translate what they have learned to their own classrooms.
- If the Program goal is truly to help develop long-term relationships, consider ways of promoting this goal explicitly, for example by encouraging PIs to recruit teachers from a single school or school district, preferably in a low-income area.
- Increase participant awareness and understanding of the Program by preparing a brochure outlining the Program goals and requirements. Request that PIs distribute the brochure to all RET applicants.

Highlights of Participant Feedback

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.

I think the single most important outcome of participation in RET was a better knowledge of how science is used in the real world and how the STEM skills can be applied to problem solving in all areas of life.

My experience was very rewarding for me. I had a positive interaction with my team, a unique experience as a researcher, established connections that will benefit me in the future, and could bring the researcher experience back to my classroom in the ways I involve my students in their learning. Thank you!

I was invigorated, informed, broadened, and enriched by the experience. This is one of the best summer programs I ever participated in.

[Integrating technology into the classroom] is something that universities need to do by reaching out to teacher education programs and school districts. The younger the student the better!

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. I wound up teaching the activities to the other teams while they covered my classes. So instead of just reaching my students, I was able to connect with the entire eighth grade, approximately 400 students.

RET programs are extremely valuable for new STEM teachers, enabling them to learn more content in their field, and valuable for experienced teachers, enabling them to update their skills and content knowledge.

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.

I. INTRODUCTION

BACKGROUND

Initiation of the Research Experiences for Teachers (RET) Program

The RET Program was initiated in FY 2001 by the Directorate for Engineering (ENG) of the National Science Foundation (NSF), inspired by the popularity of the Research Experiences for Undergraduates (REU) Site and Supplement funding mechanisms. The October 2000 "Dear Colleague" letter inviting RET Supplement proposals from researchers with active ENG research awards stated:

> The goal of the RET Supplements is to help build long-term collaborative relationships between K-12 teachers of science and mathematics and the NSF research community. The Directorate for Engineering at NSF is particularly interested in encouraging its researchers to build mutually rewarding partnerships with teachers at inner city schools and less well-endowed school districts.

Proposers were instructed to describe the nature of the prospective teacher's involvement in the research and the follow-up that would be provided to help ensure that the teacher's research experiences would be translated into classroom activities. Supplements were 1-year awards covering up to two teachers' stipends, plus up to $1,000 for materials for developing classroom instructions and experiments, up to a total of $10,000 per teacher. RET activities could occur during the summer, the academic year, or both.[1] In January 2001, the Engineering Research Centers (ERC) Program within ENG also announced RET supplemental funding opportunities for the ERCs, as one of a number of eligible education activities. Within ERCs, RET funds of up to $50,000 per year for up to 3 years were available.

Changes to RET in FY 2002

In FY 2002, the ENG RET activity was expanded to include stand-alone RET Site awards, analogous to (and often operated in conjunction with) REU Site awards. RET sites are required to "have a well-defined focus, with clearly articulated projects and activities for participating teachers;" they should normally be at least 4 weeks long; and they should involve at least five teachers. As with RET supplements, the sites are required to provide "sustained follow-up" to help translate research activities to the classroom. Also, for both sites and supplements, participation of teachers who are women, underrepresented minorities, and persons with disabilities is strongly encouraged. Per-teacher funding levels for sites are the same as those for supplements, but sites may be awarded up to $150,000 per year for up to 3 years.

Several additional changes were made in the FY 2002 ENG RET "Dear Colleague" letter including:

[1] Then and now, RET research—in both supplements and sites—occurs during the summer, with follow-up during the academic year. Thus, RET supplements tend to differ from REU supplements in that the bulk of RET activities usually occur during an intensive summer program, whereas REU supplement activities are more likely to be spread out over the academic year, while the student is attending classes.

- Preservice teachers were added to the target audience.
- Partnerships with schools supported through the NSF Urban Systemic Program (USP) were specifically encouraged (with additional funds for such partnerships available through the USP).
- The goal of encouraging “more K-12 students to pursue engineering studies by increasing their understanding of engineering, as conveyed by their teachers” was articulated.

Also in FY 2002, two other NSF directorates—Biological Sciences (BIO) and Computer and Information Science and Engineering (CISE)—also offered RET Supplement awards analogous to those offered by ENG, and the Mathematical and Physical Sciences (MPS) directorate offered both Supplement and Site awards.

RET in FY 2003

In FY 2003, the ENG RET Program was again expanded, this time to include community college faculty. Other Program requirements for sites and supplements were unchanged from FY 2002. As described in the FY 2003 RET Program solicitation, it was intended that the teacher-researcher partnerships built through RET experiences will:

- Build long-term collaborative relationships between both inservice and preservice K-12 teachers, community college faculty, and the engineering research community.
- Support the active participation of these teachers and future teachers in research and education projects funded by NSF ENG.
- Facilitate professional development of K-12 teachers and community college faculty through strengthened partnerships between institutions of higher education and local school districts.
- Encourage researchers to build mutually rewarding partnerships with teachers.

It is intended that the research activities occur over a period of at least 4 weeks during the summer, with “sustained follow-up” over the course of the subsequent academic year. Although not discussed explicitly in the program solicitation, RET also funds several week-long teacher workshops.

STUDY OBJECTIVE

The primary objective of this study was to better understand how ENG RET experiences affected participants’ teaching techniques, attitudes about teaching, and professional development activities. Outcomes and impacts beyond the teachers’ own classrooms, such as knowledge transfer activities and formal partnerships formed between the institution of 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 project 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.

SURVEY METHODS

Obtaining Participant Contact Information

The 2004 survey population consisted of 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). Efforts to obtain participant contact information were initiated by NSF program officers in the three ENG divisions participating in the study, who e-mailed their RET-award PIs, requesting names and contact information for all participating teachers. After several months, this task was turned over to SRI staff. Ultimately, 512 RET participants (each with an e-mail or postal address) were identified by a total of 102 PIs, out of the 127 PIs who had been identified by NSF. Six of the 512 teachers participated in the pretest, leaving 506 in the initial sample for the 2004 survey.

The 2006 survey population consisted of 2004 and 2005 participants in all RET Site and Supplement awards made through ENG. For this survey, SRI contacted NSF program officers to obtain PI contact information and then contacted each PI to obtain participant contact information. Communication with PIs was primarily through e-mail, with telephone calls made as appropriate for reminders and clarification of information needed or provided. PIs provided information for 475 individuals, who comprised the initial 2006 sample.

Questionnaire Development

To help guide development of the 2004 questionnaire, SRI consulted with the NSF program officer who was managing the study and the ENG RET coordinator, reviewed earlier studies of RET projects conducted by PIs, and interviewed study authors and others knowledgeable about the Program. We also were guided by our experience surveying REU participants.

Prior to the 2006 survey, 10 brief interviews were conducted with respondents to the 2004 survey to clarify their responses to some of the survey questions. On the basis of these interviews and discussions with the ENG RET program officer and SRI's project officer, we made a few small modifications to the questionnaire. Questions about whether a partnership between the participant's school and the RET university existed (which were misinterpreted by some respondents) were replaced with questions about whether others from the school had participated in RET. Also, several new items were added about whether specific kinds of follow-up activities had occurred.

For the 2004 survey, the questionnaire was pretested with six RET participants to help ensure that the questions were clear and easily understandable and that most respondents would be willing and able to provide the information requested. Pretests were conducted by faxing the questionnaire to individuals who had agreed to help and then having each individual answer the questionnaire in a telephone interview with an SRI researcher. During each pretest session, the SRI researcher probed for areas of potential difficulty or ambiguity. Modifications made as a result of pretests were then pretested with other individuals to confirm that the changes were indeed improvements. For the 2006 survey, the sections in which changes were made were pretested with eight RET participants, following the same procedures as in 2004. Because they pretested just a portion of the questionnaire, the 2006 pretest participants were asked and agreed to also participate in the full survey.

After the questionnaire for each survey was finalized, it was formatted in HTML for a Web-based data collection effort. The Web version was tested to be sure that skip logic was correct and that responses were retrieved and reported correctly by the survey software. The Word version of the 2006 questionnaire, annotated with the topline results from the combined 2004 and 2006 surveys, comprises Appendix A to this report. Survey topics are outlined below.

Independent variables

Teacher characteristics:

- School location (geographic region; urban, suburban, rural)
- Teaching or school level
- Educational background
- Number of years as a teacher
- Subjects taught

RET project activities and characteristics:

- Year(s) of participation
- Project duration
- Pre-project contacts with mentor
- Teachers' summer RET activities
- Post-project follow-up activities
- Relevance of RET activities to subjects taught
- Type(s) of organization at which project took place

NSF characteristics:

- RET mechanism (site vs. supplement)
- Directorate and division of RET award

Outcome variables

Teachers' reports of RET experiences

- Level of satisfaction/dissatisfaction with different aspects of the project/Program
- Impact of the project on various dimensions (e.g., understanding of fundamental STEM concepts, awareness of STEM career options, confidence as a STEM teacher, enthusiasm for teaching)

Teaching-related changes, such as:

- Revision or development of new content for lessons/labs
- Inclusion of examples/applications from RET experiences in teaching
- Counseling students about STEM careers
- Greater use of instructional strategies derived from RET experience

Other professional outcomes:

- Enrollment in STEM or STEM education courses or programs
- Increased involvement in other STEM-related activities
- Career changes
- Turnkey and institution-level effects, such as:
    - Workshops for other teachers

- Sharing of RET-derived equipment/materials with other teachers
- Continuing contact with RET mentors/researchers or other RET teachers

Impact variables

Teachers' reports of changes in students':

- Attitudes about STEM subjects
- Learning of STEM subjects
- Changes in career aspirations

Obstacles to transferring RET experiences to the classroom

- Level of knowledge needed for RET too high for teachers' students
- Insufficient support from RET team
- Scientific topics covered in RET unrelated to subjects taught
- Not enough time
- Cost of materials and equipment
- School curriculum that does not allow for changes
- Resistance by other teachers or administrators

Survey Data Collection and Cleaning

For both surveys, the data collection was conducted primarily online, supplemented with postal mailings to sample members who did not have a valid e-mail address. The e-mail notification and postal cover letter included a brief study overview describing study objectives, funding, privacy and burden, how the participants were selected, and how to obtain a copy of the study results or more information about the study. A survey ID number was embedded in the URL and placed on the front of the mailed questionnaire so that SRI could identify those who had responded and remove them from the follow-up list.

For sample members who had e-mail addresses (471 in 2004 and 475 in 2006), the first step in administering the questionnaire was to e-mail them a survey notification, directing them to a Website to complete the questionnaire. In 2004, seven follow-up reminders were e-mailed over a 14-week period—from the end of July through early November. In 2006, e-mail reminders were sent approximately weekly for 9 weeks, from mid-February through mid-April.

Questionnaires were sent by postal mail to 82 individuals in 2004 and to 5 individuals in 2006. A reminder postcard was mailed a week after the initial mailing, followed by a second copy of the questionnaire in 2 weeks and a third copy (in 2004) a month later. In 2004, SRI made a final attempt to contact by phone 174 individuals who had not yet responded, to encourage their response. In 2006, a phone call was made to 34 individuals.

Respondents who reported participating in the program for less than 2 weeks were deleted from the file (36 in the 2004 survey and 1 in 2006). Four additional respondents were deleted in 2006 because they did not appear to be legitimate RET participants, and one 2004 duplicate response was deleted. Twenty-eight individuals responded to both surveys. For these "dual" respondents, we created a single record that was comprised primarily of their 2006 responses, because most of the survey questions ask about cumulative RET experiences and effects; for questions that asked for a summer-specific response, we kept both the 2004 and 2006 responses. The final file used in the analyses reported here consists of 631 respondents, 237 from the 2004 survey (excluding the "dual" respondents) and 394 from the 2006 survey. The response rates for the two surveys were 73% and 86%, respectively.

The disposition of the survey samples is presented below.

		2004 Survey		2006 Survey	
a.	Valid questionnaire	265		394	
b.	Refused	22		3	
c.	Incomplete questionnaire	3		2	
d.	Total known eligible		290		399
e.	Not RET participants	64		7	
f.	Participated only in a year not covered by the survey	12		3	
g.	Participated for less than 2 weeks	36		1	
h.	Miscellaneous ineligibles	1		4	
i.	Total known ineligible		113		15
j.	Bad address	37		8	
k.	No response	66		53	
l.	Total unknown eligibility		103		61
m.	Total initial sample		506		475
n.	Total estimated eligible	364		458	
	Response rate	73%			86%

The survey response rates were calculated as the percentage of those known or estimated to be eligible who completed the questionnaire, as follows:

1. Calculate the eligibility rate of those with known eligibility as the total known eligible (row d) divided by the total known eligible plus the total known ineligible (rows d+i).
2. Multiply the result of Step 1 by the number of cases with unknown eligibility (row l).
3. Add the number estimated to be eligible in Step 2 to the total known eligible (row d). The result is presented in row n.
4. Divide the number of valid questionnaires (row a) by the total estimated eligible (row n).

Table I-1 shows the numbers of individuals in the initial samples and the total number of valid questionnaires, by RET type (site vs. supplement) and ENG division.

Data Analyses

Data analyses focused largely on describing and explaining the outcomes and impacts of the projects/Program. Descriptive tabulations were used to show the percentages of participants, overall and by subgroups, who experienced the various outcomes. In the explanatory analyses, we used factor analyses to develop indices of outcomes and impacts. We then used crosstabulations and *t*-tests to compare mean "outcomes scores" across subgroups of respondents.

Table I-1

Survey Sample and Valid Respondents, by Year of Survey, RET Type, and ENG Division

Division	Site or Supplement	Initial Sample	Valid Respondents
2004 survey			
EEC	Site	283	172
EEC	Supplement	151	42
DMII	Supplement	53	40
BES	Supplement	19	10
unknown	unknown	--	1
2004 total		**506**	**265**
2006 survey			
BES	Supplement	3	3
CMS	Supplement	30	27
CTS*	Supplement	4	3
DMII	Supplement	44	34
DMII	Site	2	2
ECS	Supplement	6	5
EEC	Site	159	140
EEC	Supplement	180	139
OAD*	Supplement	8	7
OII	Supplement	39	34
2006 total		**475**	**394**

*includes those jointly funded by EEC.

Note that 28 individuals responded to both surveys; each of these individuals is represented by a single record in the final data file. The total combined number of respondents thus = 265 + 394 – 28 = 631.

Sources: SRI International RET surveys, 2004 and 2006.

Survey responses were analyzed by the variables listed below. See Appendix A for the full wording and topline responses to these (and all other) survey questions.

- Type of RET award: Site, Supplement
- Year of survey: 2004, 2006
- Summer of participation: 2001/2002 only, 2003 only, 2004 only, 2005 only, more than one summer (Q1A)
- Number of summers of participation: single-summer, multi-summer (Q1A)
- Number of different kinds of summer RET activities: fewer than 7, 7 to 9, 10 to 12, 13 to 16 (Q8SUM)
- Total hours of RET summer participation: fewer than 170, 170 to 230, 231 to 320, more than 320 (Q16 x Q17)

- Amount of follow-up interaction: none, a little, some, quite a bit, a great deal (Q12)
- Perceived relevance of RET activities to subjects taught: not at all relevant, somewhat relevant, very relevant (Q15)
- Type of school: elementary/middle school, high school (Q35)
- School location: rural, suburban, urban (Q37)
- Percentage of school student body eligible for a free or reduced-price lunch: <25%, 25% to 49%, 50% to 74%, 75% or more (Q38)
- Percentage of respondent's students who have access at home to the Internet: <25%, 25% to 49%, 50% to 74%, 75% or more (Q33)
- Years as a teacher: 10 or fewer, more than 10 (Q40)
- Highest academic level completed: less than Master's, Master's, higher than Master's (Q42)
- Relationship between academic degree and subjects taught: no STEM degree, no STEM disciplinary degree but STEM education degree, STEM disciplinary degree but not in subjects taught, STEM disciplinary degree in some but not all subjects taught, STEM disciplinary degree in all subjects taught.
- Age: younger than 40, 40 or older (Q44)
- Gender

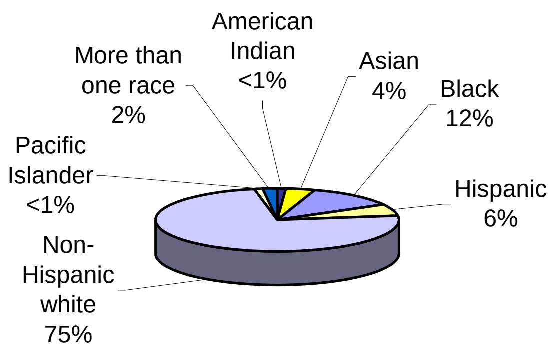
Subgroup comparisons noted in this report are statistically significant at the .05 level. This means, essentially, that the odds are less than 5 in 100 that the "significant" difference occurred only by chance. Because statistical significance does not necessarily connote practical importance, we use statistical significance as a necessary but not sufficient cause for remark; typically, unless a percentage difference is greater than 10 percentage points *and* is statistically significant, we do not consider it to be noteworthy.

II. PROFILE OF 2001-2005 ENG RET PARTICIPANTS

The 2004 survey population included all 2002 and 2003 participants in ENG RET Site awards and all 2001 to 2003 participants in ENG RET Supplement awards made by ERC, BES, and DMII. The 2006 survey population included all 2004 and 2005 participants in RET Site and Supplement awards made by any of the ENG divisions. For simplicity we will refer to the survey population/respondents as "2001-2005 ENG RET Participants." This chapter provides a broad description of the demographic and academic characteristics of the 2001-2005 ENG RET participants. The survey data presented here are based on information provided by a total of 631 respondents.

DEMOGRAPHIC CHARACTERISTICS

Figure II-1
Distribution of 2001-2005 ENG RET Participants, by Race/Ethnicity



Sources: SRI International RET surveys, 2004 and 2006.

Figure II-1 shows the distribution of 2001-2005 ENG RET participants by race/ethnicity. Three-fourths were non-Hispanic whites. Among the minority groups, blacks had the highest representation, with 12%. As a very approximate comparison, 84% of K-12 teachers nationwide were non-Hispanic whites, 7% were black, and 5% were Hispanic.[2] Participants were approximately evenly divided between men (52%) and women (48%). It would appear from these data that the Program is doing a reasonably good job of recruiting groups that are traditionally underrepresented in STEM fields. ENG RET participants also were well distributed across age decades, with 46% under age 40 and 54% age 40 or older.

Almost all ENG RET participants (96%) were teachers immediately before participating in the Program, and 91% were teachers at the time of the survey. The 38 individuals who were teachers before RET but not at the time of the survey reported a variety of occupations, including school administrator, curriculum specialist, student, non-education fields, unemployed, and retired.

ACADEMIC CHARACTERISTICS

As is often true of enrichment program participants, the ENG RET participants tended to be better educated than the average K-12 teacher: 64% had at least a master's degree and 7% had a doctorate; the comparable percentages for K-12 teachers nationwide were 45% and less than 1%. Also, ENG RET participants averaged about 13 years of teaching experience, 3 years less than the 16-year average for K-12 teachers nationwide.[3]

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[2] Percentages were calculated using statistics provided by the 1999-2000 Schools and Staffing Survey (SASS), National Center for Education Statistics, available. at http://nces.ed.gov/surveys/SASS/. To make direct comparisons between ENG RET participants and all U.S. K-12 teachers one would need to weight on a variety of dimensions, including subjects taught and school level. Such an effort is beyond the scope of this study.

[3] Nationwide statistics noted in this paragraph were obtained from SASS, as cited above.

The academic fields in which participants obtained their degrees are presented in Table II-1. As undergraduates, 73% of ENG RET participants majored in a STEM field; 13% majored in STEM education. In contrast, participants' master's degrees were most likely to be in general education (45%). Among the few doctorates, 74% were in disciplinary areas.

Table II-1

Academic Fields of 2001-2005 ENG RET Participants' Bachelor's, Master's, and Doctoral Degrees

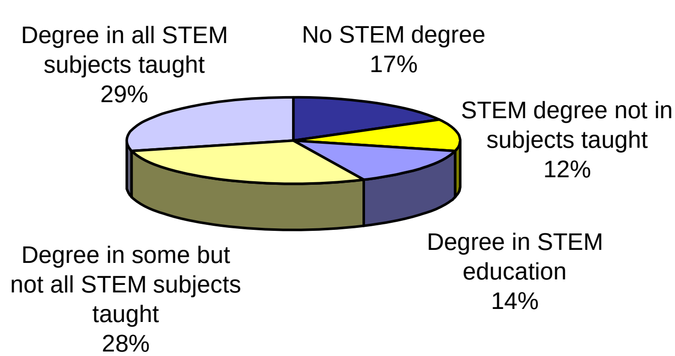
	Bachelor's (n = 603)	Master's (n = 392)	Doctorate (n = 47)
STEM			
Chemistry	12%	4%	21%
Engineering/technology	8	7	15
Life sciences	29	9	19
Mathematics	10	3	4
Physical/earth sciences	14	7	11
Social sciences	9	3	4
Science (general)	2	1	0
Education			
STEM education	13	24	9
Education (general)	13	45	17
Other	12	8	2

This table shows, for example, that 12% of ENG RET participants who received a bachelor's degree majored in chemistry. Columns sum to more than 100 because respondents were able to select more than one category.

Sources: SRI International RET surveys, 2004 and 2006.

Of the participants who were teaching a STEM subject at the time they were surveyed, 69% had at least one degree in a STEM disciplinary field, excluding social sciences; 14% did not have a STEM disciplinary degree but did have a degree in STEM education (Figure II-2).

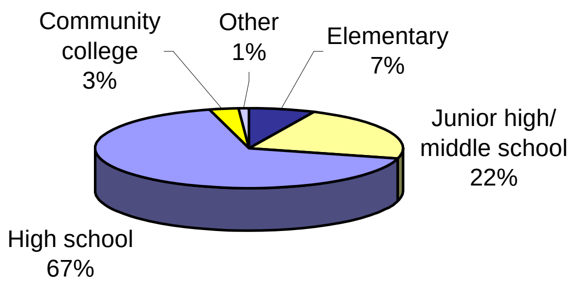
Figure II-2
Relationship of Academic Degrees to Subjects Taught: 2001-2005 ENG RET STEM Teachers



Sources: SRI International RET surveys, 2004 and 2006.

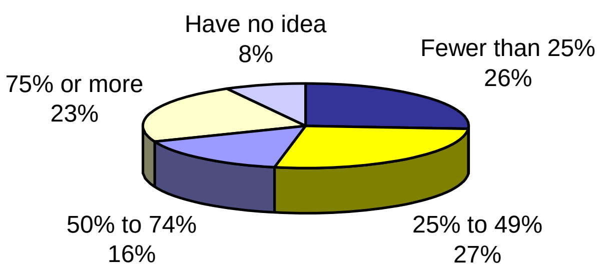
SCHOOL CHARACTERISTICS

Figure II-3
Distribution of 2001-2005 ENG RET Teachers, by Level of School in Which They Taught



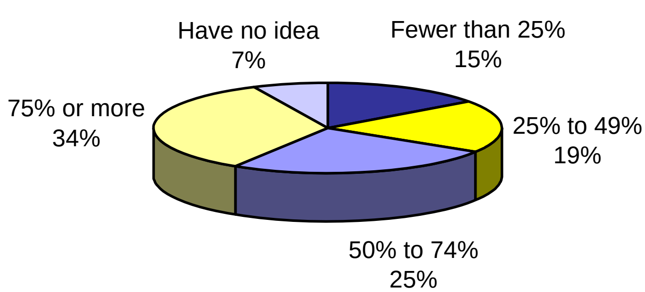
Sources: SRI International RET surveys, 2004 and 2006.

Figure II-4
Distribution of 2001-2005 ENG RET Participants, by Percentage of Their School's Student Body Eligible for Subsidized Lunch



Sources: SRI International RET surveys, 2004 and 2006.

Figure II-5
Distribution of 2001-2005 ENG RET Participants, by Percentage of Their Students Who Have Home Internet Access



Sources: SRI International RET surveys, 2004 and 2006.

As noted above, 91% of the respondents indicated that at the time of the survey they were teachers. Two-thirds of the teachers taught in high schools, and 22% were in junior high or middle schools (Figure II-3). Among those in K-12 schools, the vast majority (78%) taught in public district schools; 14% taught in public magnet schools, 6% taught in private schools, and 2% taught in other kinds of schools. About half (45%) of the schools were urban, 40% were suburban, and 15% were rural. As a group, ENG RET teachers taught a diverse array of STEM topics, of which physics (taught by 30% of participants), biology (27%), chemistry (27%), and math (26%) were the most common.

NSF encourages RET PIs to develop partnerships with teachers in inner-city schools and less well-funded school districts. As a proxy, we asked respondents to indicate the approximate percentage of students at their school who were eligible for a free or reduced-price lunch (fewer than 25%, 25% to 49%, 50% to 74%, 75% or more, or have no idea). About 4 in 10 reported that at least half of the students were eligible for a subsidized lunch. (Figure II-4).

Another indication of student affluence is the percentage who have access to the Internet at home. Given the same response categories as were used for the school lunch question, 59% said at least half had home Internet access; only 15% said fewer than 25% had home Internet access (Figure II-5). The sizeable number of teachers with high percentages of subsidized-lunch students indicates that low-income schools were indeed represented by RET participants; however, the sizeable number with high percentages of students with home Internet access indicates that more affluent schools also are well represented.

SUMMARY OF PROGRAM PARTICIPANTS' CHARACTERISTICS

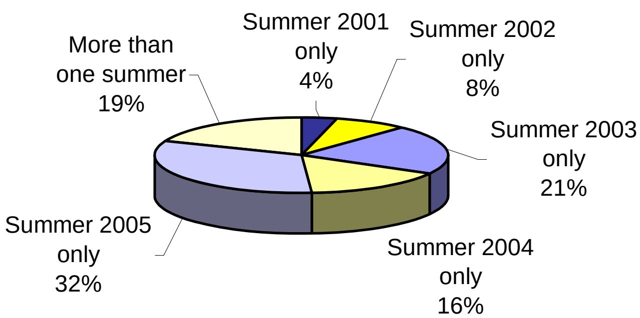
ENG RET participants in 2001 through 2005 were a diverse group demographically as well as in terms of the schools in which they taught and the STEM subjects they taught. One notable difference between participants and the average K-12 teacher was that participants were considerably more likely to have obtained an advanced degree. Low-income schools appeared to be represented but, despite NSF's encouragement to PIs to include them, they did not predominate.

III. PARTICIPANTS' RET EXPERIENCES

SUMMERS OF PROJECT PARTICIPATION

The vast majority of the respondents (81%) participated in the Program for only one summer (Figure III-1). The number of participants appears to have increased considerably between 2001 and 2005, with 47 respondents (4%) who participated only in 2001 and 201 (32%) who participated only in 2005. However, the distribution by summers also reflects two methodological artifacts: PIs (contacted in 2003 and 2005) were more likely to have names and contact information for recent participants than for those who participated further in the past, and the 2004 survey included fewer ENG divisions than did the 2006 survey.

Figure III-1
Distribution of 2001-2005 ENG RET Participants, by Summer of RET Participation



Sources: SRI International RET surveys, 2004 and 2006.

LOCATION OF PROJECT PARTICIPATION

For almost all participants (89%), the summer RET experience took place at least in part at a 4-year college or university. No other location was cited by more than 7% of respondents. Most common of these were for-profit companies (e.g., Small Business Innovation Research Program awardees), with 7% of participants, and medical facilities, with 5%. Other project locations included U.S. government labs, non-profit research organizations, the participant's school, and the participant's home.

By far the most common mode of attendance in the summer projects was to commute, reported by 85% of participants. Eleven percent were housed on or near their RET institution, and the remaining 4% commuted during some of the project and were housed on campus for other parts.

PREPARATIONS FOR PARTICIPATION IN RET

The most common kinds of pre-project contact by participants were phone calls or e-mails with the RET mentor, PI, or project coordinator, reported by 85% of respondents. About two-thirds (64%) of respondents said they received materials describing the RET work they would be doing, and 58% met in person with a project representative to discuss their upcoming summer activities. Almost nine in ten respondents (87%) reported that they attended some kind of in-person individual or group orientation session at the start of the summer project.

About two-thirds of respondents reported that, when they started work during their first RET summer, they were "very well informed" about project logistics such as locations of activities, parking, meals, administrative issues, and so on (Table III-1). Approximately 5 in 10 were very well informed about the summer's scheduled activities, the summer project's objectives, what the participants were expected to accomplish, and the overall RET Program objectives. Participants who were involved in three or four of the preparatory activities noted in the preceding paragraph were more likely than those who were involved in fewer than three to have said they were very well informed. Nevertheless, fewer than half (42%) of those who were involved in all four preparatory activities reported that they were very well informed on all dimensions shown in Table III-1.

Table III-1

How Well Informed 2001-2005 ENG RET Participants Were at the Start of Their First RET Summer, by Category of Information (listed in descending order of mean rating)

	n	Mean Rating	Not At All Informed	Somewhat Informed	Pretty Well Informed	Very Well Informed	Don't Remember
Project logistics (locations of activities, parking, meals, administrative issues, etc.)	629	3.56	2%	8%	21%	67%	1%
The scheduled activities for the summer	628	3.40	3	13	25	59	1
The overall RET Program objectives/goals	631	3.30	3	17	28	52	1
The objectives/goals of your RET summer project	628	3.26	3	18	27	51	1
What you were expected to do/accomplish during the summer	629	3.23	3	18	31	47	1

This table shows, for example, that 2% of the participants reported that they were not at all informed about project logistics when they started work during their first RET summer.

Note: Mean ratings are based on a 4-point scale in which 1 = not at all informed, 2 = somewhat informed, 3 = pretty well informed, and 4 = very well informed.

Sources: SRI International RET surveys, 2004 and 2006.

SUGGESTIONS FOR IMPROVING PREPARATORY MEETINGS AND INFORMATION

Asked how they thought the preparatory information, meetings, or orientation session could be improved, about 100 respondents in each survey provided suggestions or comments about difficulties. In both surveys, the most common suggestion was for more information about project activities and objectives and participant responsibilities. For example:

The orientation session should include a syllabus of some sort, scheduling out activities for specific days and setting clear goals.

Give teachers more specific information as to what each one or group of them will be specifically doing, with whom, and purpose. Then, begin to introduce the connection of what we will be learning with our teaching curriculum and applications of it.

The PIs should be present at the orientation and give small overviews of their projects including goals and objectives.

I would have liked more information about how the summer experience was linked to the experience during the school year.

An outline of what was expected at the beginning, middle, and end of the RET program would have been helpful. For example, letting participants know early-on about objectives, topics, and the required ending presentation would be helpful.

A number of respondents suggested that having more information in advance would have been useful.

Since I am a teacher, I need to plan my summer activities well in advance of June. It was not confirmed what I would be doing, if anything, until the beginning of April. I usually have the summer planned by the end of February.

I never received any written information concerning the goals of the project and requirements of RET. I was only orally briefed. A mailed package of info would have been helpful.

Communication with my mentor before the start of the program might have helped to get my project rolling more quickly.

I think that having information sent prior to my arrival that would have given me a preview of objectives would have been beneficial.

In both surveys, several respondents wanted more information about the RET Program itself, as distinct from information about their RET project. At least a few respondents in both surveys had no idea that the Program they participated in was RET. (Lack of awareness of the Program appears to have been a larger problem in 2004 than in 2006. In the 2004 survey, 63 of the individuals contacted responded that they were not RET participants and therefore declined to complete the questionnaire; in the 2006 survey, only 7 individuals said they were not RET participants.)

Provide an overview of the RET Program, discuss the program's beginnings, history, and current status. Discuss future goals and objectives of the program.

Overall outline identifying the Program and goals would be helpful.

Was never told the funding came from RET, so I didn't know I was part of RET at the time. I'm guessing that my 2002 experience was the one funded by RET.

None of the meetings introduced the RET Program. I was unaware that the funding source was NSF.

SUMMER ACTIVITIES

Although the RET Program was inspired by the Research Experiences for Undergraduates (REU) Program, participants' activities in the two programs are quite different. The undergraduate experience focuses heavily on doing research, whereas the teacher experience focuses much more on watching, listening, and developing classroom plans. Thus, for example, 86% of REU Site participants but only half (51%) of RET participants reported that they collected and/or analyzed data or information to try to answer a STEM research question. Still, only 7% of RET participants (and 6% of REU participants) said that they "did little or nothing that seemed to me to be real research."

I became familiar with plant cell cloning and transgenic applications

[We developed] a lesson plan bank of "real world" lessons.

I learned about local STEM opportunities for my students.

I got to see real research at a research facility.

Table III-2 shows the percentages of respondents who reported doing each of the 17 activities listed in the questionnaire. The three most common were: worked on a plan for applying aspects of what I learned in RET to my classroom

Table III-2

Percentage of 2001-2005 ENG RET Participants Who Reported Engaging in Each Listed Activity During the RET Summer Program

Worked on a plan for applying aspects of what I learned in RET to my classroom teaching	84
Observed research activities performed by researchers/faculty at the host institution	82
Worked on developing curricula/lesson plans for my classroom	79
Prepared/delivered a poster presentation, written report, or oral presentation describing my RET accomplishments to other RET participants, my mentor, etc.	77
Read academic literature, journal articles, etc	77
Practiced using scientific equipment or specific scientific procedures	76
Attended demonstrations of the use of scientific equipment or specific scientific procedures	72
Attended lectures about current topics/techniques in science, technology, engineering, or mathematics (STEM)	71
Did Internet searches on issues related to translating STEM topics to the classroom	67
Assisted faculty/researchers with their research	63
Went on research-related field trips (to other labs on- or off-campus, industry research sites, outdoor research sites, etc.)	56
Collected and/or analyzed data or information to try to answer a STEM research question	51
Attended lectures/demonstrations/workshops about strategies for teaching STEM concepts	46
Received formal or informal training in technical writing/presentation skills	46
Worked on a STEM research project for which I had major responsibility	41
Did little or nothing that seemed to me to be real research	7
Other major summer activities	6

Sources: SRI International RET surveys, 2004 and 2006.

teaching (84%), observed research activities performed by researchers/faculty at the host institution (82%), and worked on developing curricula/lesson plans for my classroom (79%).

There were few appreciable differences in activities between the two surveys or between single-summer and multi-summer RET participants. Where there were differences, 2001/2002 participants tended to be less likely than others to have engaged in an activity. Activities with the largest differences were doing Internet searches, working on plans to apply RET experiences to the classroom or on classroom curricula/lesson plans, and working on a STEM research project for which the respondent had major responsibility (Table III-3).

Participants in RET Sites had somewhat higher participation rates in most of the activities than did participants in RET Supplements. Differences were largest with regard to reading academic literature (89% vs. 71%, respectively) and doing Internet searches (77% vs. 62%). Overall, Site participants participated in an average of 11 activities, compared to an average of 9.5 by Supplement participants. Rates of participation in the various activities tended not to be affected very much by school characteristics (school level, location, or percentage of students receiving subsidized lunches) or teacher characteristics (years of teaching, highest academic degree, age, sex, or relationship of academic degree to subjects taught). However, older teachers and those with more teaching experience tended to participate in slightly more activities in total than did their younger, less experienced counterparts.

Table III-3

Percentage of 2001-2005 ENG RET Participants Who Reported Engaging in Selected Activities During the RET Summer Program, by Summer of RET Participation

	2001 or 2002 Only	2003 Only	2004 Only	2005 Only	More Than One Year
Worked on a plan for applying aspects of what I learned in RET to my classroom teaching	68	82	86	87	90
Worked on developing curricula/lesson plans for my classroom	64	72	84	84	85
Worked on a STEM research project for which I had major responsibility	28	36	32	50	50
Did Internet searches on issues related to translating STEM topics to the classroom	37	60	71	76	74

This table shows, for example, that 68% of those who participated in RET only in 2001 or 2002 reported that they worked on a plan for applying aspects of what they learned in RET to their classroom teaching.

Sources: SRI International RET surveys, 2004 and 2006.

On average, participants were involved in about 10 activities of the 16 activities listed (excluding "no real research"). For analyses assessing the relationship between number of RET summer activities and RET outcomes, respondents were divided into four categories: fewer than 7 activities (16% of respondents), 7 to 9 activities (26%), 10 to 12 activities (31%), and 13 to 16 activities (27%).

DURATION AND INTENSITY OF SUMMER ACTIVITIES

For most participants, RET summer projects entailed several weeks of intensive activities. The 2003 RET Program announcement[4] states that RET summer projects should be at least 4 weeks long, and this was indeed the case for all but 7% of respondents. The average duration was 6.4 weeks. Most also reported that while the project lasted, it was essentially a full-time experience. On average, respondents worked 35 hours per week on RET, for a total of 256 hours. Participants in RET Sites tended to participate over a longer period of time than did those in RET Supplements (7.0 vs. 6.2 weeks), for a correspondingly greater number of total hours (288 vs. 242).

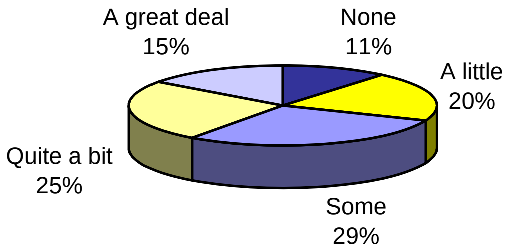
Asked how many weeks they would have liked the RET summer activities to have lasted, considering their own needs, interests, time constraints, and so on, respondents reported an average of 6.0 weeks, only slightly below the 6.4 weeks they actually spent. Similarly, 92% of respondents said they thought the overall summer work load was "about right."

ACADEMIC YEAR FOLLOW-UP

Although follow-up is supposed to be a central element of RET, there was considerable variation in the amount of continuing interaction between RET participants and their mentors or other faculty and graduate students with whom the participants interacted during the summer projects (Figure III-2). Fewer than half (40%) reported quite a bit or a great deal of follow-up.

[4] The 2003 announcement was the most recent available as of May 2006.

Figure III-2
Distribution of 2001-2005 ENG RET Participants, by Amount of Follow-up Interaction



Sources: SRI International RET surveys, 2004 and 2006.

I have an NSF fellow visit me (on average) twice a week.

[The most important impact of RET] has been the grad students coming into the classroom and doing hands-on demonstrations.

The most important impact that RET had on my students was that they were able to go to the University and see some of the demonstrations and equipment in use.

Having ongoing long term support re: training, equipment and curriculum development makes all the difference in making sure that I apply the material in my classroom and continue to develop new curriculum.

The best experiences I have had are where the group returned during the school year (for a weekend) to share how implementation in the classroom worked.

Predictably, follow-up was related to multi-summer participation. For instance, 31% of those who reported quite a bit or a great deal of follow-up have participated in RET for more than one summer, compared with only 5% of those who reported no or a little follow-up. Those who reported larger amounts of follow-up also were somewhat more likely to participate in the various RET summer activities than were those who reported less follow-up, but there was no relationship between follow-up and the number of weeks or hours per day spent on RET summer activities.

An especially interesting finding was that follow-up was strongly related to how well informed participants were at the start of their summer activities. For example, 66% of those who received a great deal of follow-up said they were very well informed about what they were expected to accomplish during the summer. In contrast, only 30% of those who received no or a little follow-up said that they were very well informed at the outset. Thus, it would appear that follow-up tends to be one component of a project that is carefully planned and thoughtfully executed, from participant recruitment through classroom implementation.

The most common type of follow-up activities reported were receipt of classroom materials, supplies, or equipment from the RET institution, reported by 50% of respondents, and announcements of workshops or other professional development activities, reported by 40% of respondents to the 2006 survey.[5] Only 31% of 2006 respondents reported that, since their summer activities had been completed, they had discussed classroom implementation issues with individuals from their RET institution,[6] and even fewer took their students to their RET institution or were visited by RET faculty or researchers (Table III-4).

[5] This question was not asked in the 2004 survey.
[6] This question was not asked in the 2004 survey.

Table III-4

2001-2005 ENG RET Follow-Up Activities: Percentage Who Reported Each (listed in descending order of percentage who reported them)

	Percentage
I have received materials, supplies, or equipment from my RET institution that I have been able to use in my classroom.	50
I have received announcements of workshops or other professional development activities from my RET mentor or others at my RET institution. (2006 survey only)	40
I have discussed classroom implementation issues with my RET mentor or others at my RET institution. (2006 survey only)	31
Faculty/researcher(s) from my RET institution came to my school to meet with my students (gave presentations, counseled about careers, etc.).	21
My students or I have had access to facilities or equipment at the RET institution. (2006 survey only)	22
I took students to my RET college/university.	15

Sources: SRI International RET surveys, 2004 and 2006.

PARTICIPANTS' REPORTS OF THEIR RET EXPERIENCES

Amount of Time Spent on Project Activities

Almost all participants indicated that their RET summer work load had been "about the right amount," and a majority also reported that they had spent about the right amount of time on several major types of summer activities (Table III-5). Participants were much more likely to report that they had spent too little time than too much time on hands-on research and curriculum development activities. Participants who reported a great deal of follow-up interaction were far more likely than those who reported no follow-up to indicate that the amount of time on curriculum development was about right (88% vs. 45%, respectively), and they were less likely to have spent too little time on curriculum development (9% vs. 48%). There were similar,

Table III-5

2001-2005 ENG RET Participant Reports of the Amount of Time on Various Kinds of RET Summer Activities (Items are listed in descending order of "about the right amount")

	n	Too Little	About the Right Amount	Too Much
Your summer RET work load overall	*624*	4%	92%	4%
The amount of time you spent attending lectures, workshops, demonstrations, and meetings	*625*	9	84	7
The amount of time you spent on hands-on research activities	*627*	19	78	4
The amount of time you spent on curriculum development or translating research experiences to the classroom	*630*	25	73	3

This table shows, for example, that 4% of the participants reported that their overall summer RET workload was too little.

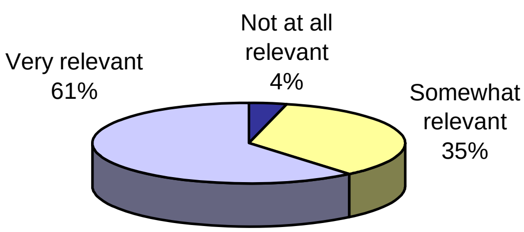
Sources: SRI International RET surveys, 2004 and 2006.

though less pronounced, differences between multi- and single-summer participants and between those who engaged in many activities vs. those who engaged in few activities.

Relevance to Classroom Activities

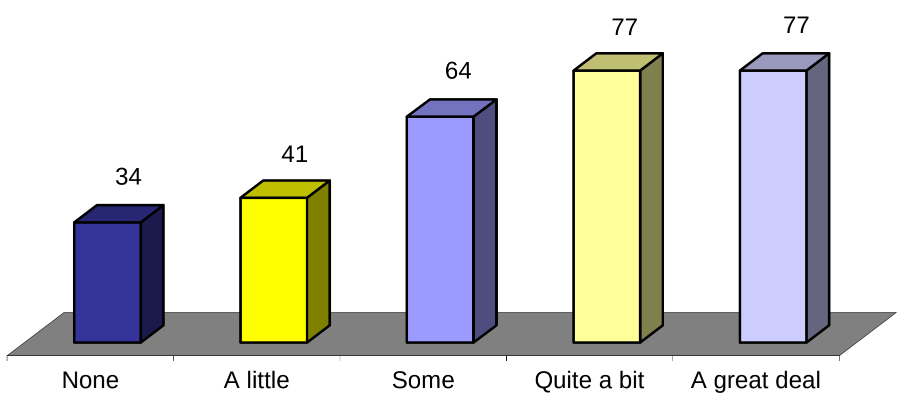
Among participants who currently teach, 61% reported that, overall, the RET activities were "very relevant" to the subjects they currently teach, 35% said RET activities were "somewhat relevant," and 4% said they were "not at all relevant" (Figure III-3). Relevance was strongly related to follow-up interaction and participation in a variety of summer RET activities. The percentage of teachers who said that their RET activities were very relevant to their classroom subjects ranged from 34% of those who reported no follow-up to 77% of those who reported a great deal of follow-up (Figure III-4) and from 48% of those who engaged in fewer than 7 activities to 79% of those who engaged in 13 to 16 activities. Thus, relevance was tightly tied in with other important program elements.

Figure III-3
2001-2005 ENG RET Participants' Reports of the Relevance of Their RET Activities to Subjects They Taught



Sources: SRI International RET surveys, 2004 and 2006.

Figure III-4
2001-2005 ENG RET Participants Who Reported that Their RET Experiences Were Very Relevant to Their Classroom Subjects, by Amount of Follow-up Interaction



Sources: SRI International RET surveys, 2004 and 2006.

Satisfaction with the Program

Respondents were asked to rate their level of satisfaction with each of 14 aspects of their RET experience. Their responses are summarized in Table III-6. Participants were most satisfied with the adequacy of their stipend, the helpfulness of the RET staff, the experience as a whole, the helpfulness of graduate students and postdocs, the timeliness of their paychecks, and their overall relationship with their mentor. On each of these items, 70% or more of the participants indicated that they were very satisfied. They tended to be somewhat less satisfied with such aspects of the experience as their mentor's knowledge of the roles and responsibilities of K-12 STEM teachers, his/her interest in helping them to develop a classroom plan, their

Table III-6

2001-2005 ENG RET Participant Satisfaction with Various Aspects of the RET Experience (Items are listed in descending order of mean ratings)

	n	Mean	Very Dissatisfied	Somewhat Dissatisfied	Somewhat Satisfied	Very Satisfied	Doesn't Apply
The adequacy of your stipend*	*630*	3.79	<1%	2%	16%	81%	1%
The helpfulness of the RET staff*	*629*	3.73	2	3	15	79	1
The experience as a whole**	*627*	3.73	1	3	17	78	<1
The helpfulness of graduate students and postdocs**	*629*	3.72	1	3	15	70	11
The timeliness of your paychecks*	*629*	3.65	3	5	15	76	1
Your relationship with your mentor, overall**	*629*	3.63	4	4	17	74	1
How well organized the summer activities were*	*625*	3.56	3	6	23	67	1
Your opportunity to interact and discuss STEM issues with other teachers during the summer program**	*626*	3.55	3	6	21	63	7
The relevance of your RET experience to the subjects you teach**	*629*	3.50	3	6	28	61	1
The amount of interaction you had with your mentor **[2006 survey only]**	*393*	3.49	4	7	24	65	1
Your opportunity to interact and discuss STEM issues with faculty/researchers**	*627*	3.45	3	9	24	58	5
Your mentor's knowledge of the roles/responsibilities of K-12 STEM teachers**	*629*	3.40	5	8	27	56	4
Your mentor's interest in helping you develop a plan to transfer what you learned to your classroom**	*629*	3.39	5	9	25	57	4
The extent to which you felt that you were an integral part of a research team**	*630*	3.25	7	12	29	50	3

This table shows, for example, that fewer than 1% of the participants were very dissatisfied with the adequacy of their stipend.

Note: Mean ratings are based on a 4-point scale in which 1 = very dissatisfied, 2 = somewhat dissatisfied, 3 = somewhat satisfied, and 4 = very satisfied.

*Part of the "satisfaction with administrative issues" index.

**Part of the "overall satisfaction" index.

Sources: SRI International RET surveys, 2004 and 2006.

I was invigorated, informed, broadened, and enriched by the experience. This is one of the best summer programs I ever participated in.

It is a large commitment, but you make a lot of great contacts, and the money is excellent.

RET has been the most useful experience that I have ever had in education.

[RET should] let us participate more in the lab. The PIs seriously underestimate the abilities and intellectual capabilities of some teachers.

The mentors I worked with were especially good at explaining to us the whole picture of their research project, then teaching us, in understandable, non-intimidating ways, what our role would be in their research.

opportunity to interact with researchers, and, especially, feeling as though they were an integral part of a research team. This last dimension, on which only 50% were very satisfied, corresponds with the relatively low percentage of participants who collected or analyzed data to answer a research question (51%).

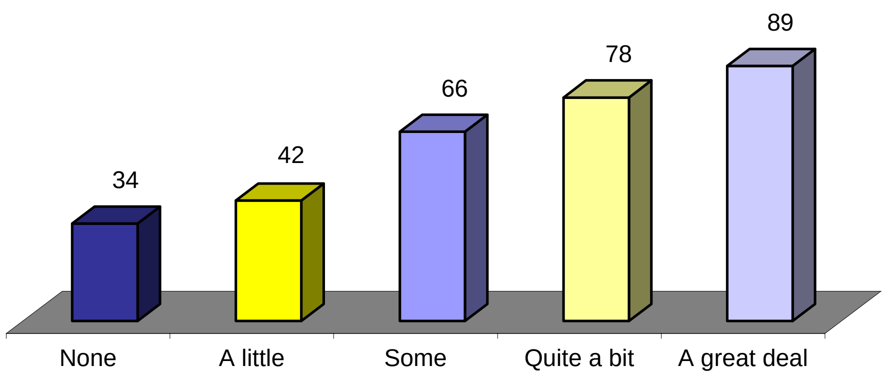
To facilitate analyses of the relationship between satisfaction and other study variables, a factor analysis was conducted to identify satisfaction items that clustered together. This analysis led to the development of two indices, which we have titled "overall satisfaction" and "satisfaction with RET administrative issues." Across all respondents, 64% were very satisfied overall, and 68% were very satisfied with RET administrative issues.[7]

Correlates of Satisfaction

The most powerful predictors of overall satisfaction with the RET project experience were the amount of follow-up interaction, the relevance of the participants' activities to the classroom subjects they taught, and number of summer RET activities

- Satisfaction and follow-up: the percentage who were very satisfied overall ranged from 34% of those who reported no follow-up to 89% of those who reported a great deal of follow-up (Figure III-5).

Figure III-5
Percentage of 2001-2005 ENG RET Participants Who Were Very Satisfied Overall with Their RET Experience, by Amount of Follow-Up Interaction



Sources: SRI International RET surveys, 2004 and 2006.

[7] Table III-4 shows which items are in each index. For each index, "very satisfied" indicates respondents who reported "very satisfied" on all items in the index.

- Satisfaction and relevance to classroom subjects: of the very few (21 individuals) who indicated that RET was not at all relevant to their classroom subjects, a mere 5% were very satisfied overall; 43% of those who said that RET was somewhat relevant to their classroom subjects were very satisfied, and 80% of those who said that RET was very relevant were very satisfied.

- Satisfaction and number of RET summer activities: only 40% of those who participated in fewer than 7 activities were very satisfied overall, compared with 84% of those who participated in 13 to 16 activities.

Of the various individual project activities, the following had the strongest relationships with overall satisfaction:

- Did little or nothing that seemed to me to be real research (only 31% of those who selected "did no real research" were very satisfied overall, compared with 67% of those who did not select this item).
- Worked on a plan for applying aspects of what I learned in RET to my classroom teaching (69% vs. 39% very satisfied).
- Worked on a STEM research project for which I had major responsibility (78% vs. 56% very satisfied).
- Collected and/or analyzed data or information to try to answer a STEM research question (76% vs. 53% very satisfied).
- Did Internet searches on issues related to translating STEM topics to the classroom (73% vs. 47% very satisfied).

Not surprisingly, multi-summer participants tended to be more satisfied with their experiences than were single-summer participants; of the single-summer groups, the 2001/2002 group tended to be the least satisfied: the percentages very satisfied overall were 46% of 2001/2002 participants, 60% of 2003 and 2004 participants, 68% of 2005 participants, and 75% of multi-summer participants.

RET vs. REU Satisfaction

Percentages of RET and REU Site participants who were very satisfied with the experience as a whole were very similar (78% and 75%, respectively), as were the percentages very satisfied with the extent to which they were an integral part of a research team (50% vs. 52%). RET participants tended to be slightly more satisfied than REU participants with how well organized the project was (67% and 59%) and the helpfulness of grad students and post docs (79% and 72% of those to whom the item applied).[8]

SUMMARY OF PARTICIPANTS' RET EXPERIENCES

The typical RET participant engaged in a full-time 6-week experience for a single summer, during which time he/she commuted to a 4-year college or university. All respondents had some kind of pre-project contact, most often phone calls or e-mails. Although a large majority considered themselves to be "pretty well" or "very well" informed about various aspects of the project/Program, only about 4 in 10 said that they were very well informed about all aspects.

[8] The four items noted here were the only satisfaction items common to the two surveys.

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, 79% worked on classroom plans, and 82% observed faculty research activities, whereas only 51% collected or analyzed data to try to answer a research question.

The extent of academic-year follow-up by RET faculty and staff varied. Four in 10 participants reported “quite a bit” or “a great deal” of follow-up, and 11% said there was none.

Far more respondents thought that there was too little time rather than too much time spent on hands-on research and curriculum development, but about three-fourths indicated that the amount of time on these activities was “about right.” About 8 in 10 were very satisfied with the experience as a whole, but only slightly over half were very satisfied with their mentor’s knowledge of the roles and responsibilities of K-12 STEM teachers or with their mentor’s interest in helping them develop classroom plans. Overall satisfaction was strongly related to the experience’s relevance to subjects taught in the classroom, to the amount of follow-up interaction with the RET team, to having participated in a variety of project activities, and to having done at least something that seemed like “real research.”

IV. RET OUTCOMES AND IMPACTS

PROJECT OUTCOMES

Survey respondents were asked whether they had experienced each of 37 different possible RET outcomes, ranging from increased awareness of current STEM research issues, to increased use of hands-on activities in the classroom, to the assumption of new leadership roles or responsibilities as a result of the RET experience (Table IV-1). Twenty-six of the listed outcomes were reported by more than half of the respondents, and 14 were reported by more than three-fourths, indicating that the Program overall had a wide variety of positive effects. The most common effects—reported by about 9 in 10 or more participants—were increases in participants' STEM knowledge base, motivation to find ways to improve student learning, ability to convey the excitement of STEM to students, awareness of STEM research issues, and confidence in their ability as a STEM teacher.

Table IV-1

2001-2005 ENG RET Participant Outcomes: Percentage Who Reported Each RET Outcome (Outcomes listed in descending order of percentage who reported them)

	Percentage	Percentage Increased "A Lot"*
Increased my general knowledge base in STEM	98	60
Increased my motivation to find ways to improve my students' learning	94	60
Increased my ability to convey the excitement/vitality of STEM to students	92	55
Increased my awareness of current STEM research issues	89	47
Increased my confidence in my ability as a STEM teacher generally	89	50
Increased my professional opportunities	83	40
Included examples or applications from my RET activities in my teaching	82	na
More since RET: tell students about or use new technologies	82	na
Increased my understanding of STEM applications in everyday life	80	36
More since RET: assign projects based on "real world" problems	79	na
Increased my understanding of how to conduct a research project	79	31
Increased my awareness of new materials/equipment (other than computers) that could be useful to me as a teacher	77	32
More since RET: integrate math, science, and technology	77	na
Increased my understanding of how scientific knowledge is built	77	30
Increased my understanding of how to deal with research setbacks, frustration, "negative results," etc.	71	28
More since RET: use hands-on activities in my classroom	70	na
Increased my skills in using the Internet to obtain information that will be helpful to my teaching	69	22
Acquired new skills in RET that I was able to use in my classroom	66	na
Increased my awareness of STEM career options	65	27

(continued)

Table IV-1 (concluded)

2001-2005 ENG RET Participant Outcomes: Percentage Who Reported Each RET Outcome (Outcomes listed in descending order of percentage who reported them)

	Percentage	Percentage Increased "A Lot" *
Implemented in classroom curricula/lesson plans developed as part of RET activities	63	na
Increased my awareness of how to use computers more effectively in my teaching	63	24
More since RET: use computers	62	na
More since RET: talk with or counsel students about careers in STEM fields	62	na
More since RET: assign joint or group projects	61	na
Increased my understanding of ethical dimensions of STEM research	58	20
More since RET: require oral presentations or written reports	56	na
Increased my awareness of magazines/professional journals that could be useful to me as a teacher	49	13
Have shared RET-derived information, materials, or other resources with other teachers in my school/district	48	na
More since RET: encourage students to access the Internet to learn more about STEM topics	39	na
Used contacts or experiences from RET to obtain new resources for my classroom	38	na
During the academic year(s), I have networked with other RET teachers about teaching or other professional issues	33	na
More since RET: read scientific/engineering journal articles	31	na
More since RET: became involved in STEM-related extracurricular activities (e.g., school science club)	29	na
As a result of my RET experiences, I began teaching additional/different subjects than I did before my RET experiences	28	na
As a result of my RET experiences, I assumed new leadership roles or responsibilities in my school/district/region	19	na
Have organized/facilitated in-service workshops for other teachers/school personnel on issues related to my RET experiences	15	na
As a result of my RET experiences, I changed jobs	1	na

*Percentage who reported that their awareness/understanding increased "a lot," given the options of "none," "some," or "a lot." Items with "na" in this column did not include an "increased a lot" response category.

Sources: SRI International RET surveys, 2004 and 2006.

Outcomes Indices

To reduce the number of variables to a more manageable number and facilitate assessments of effects, factor analyses of the outcomes items were conducted.[9] Items that were statistically correlated with one another and conceptually similar were combined into an index, resulting in a total of nine indices, each comprising between 2 and 8 survey items. These indices are summarized below. [10]

Increased Teaching Capabilities (6 items). Ability to convey excitement of STEM to students, confidence in abilities as STEM teacher, understanding of STEM applications in everyday life, and so on.

New Teaching Strategies (8 items). Assign more projects based on "real world" problems, assign more group/joint projects, implemented curricula developed in RET, etc.

Computers/Technology (5 items). Increased awareness of how to use computers effectively in teaching, increased use of computers in the classroom, and so on.

Increased Research Knowledge (5 items). Understanding of how to conduct a research project, how scientific knowledge is built, ethical dimensions of STEM research, and so on.

STEM Career Awareness (2 items). Do more talking with or counseling of students about STEM careers, greater awareness of STEM career options.

New Materials (2 items). Received materials from RET for classroom, used RET contacts or experiences to obtain new classroom resources.

STEM Publication Awareness (2 items). Greater awareness of STEM journals useful to teachers, read more STEM journals.

Networking and Sharing (4 items). Networked with other RET teachers, shared RET information/materials with others in school, and so on.

New Activities/Opportunities (5 items). As a result of RET, began teaching new subjects, involved in STEM club, new leadership roles, and so on.

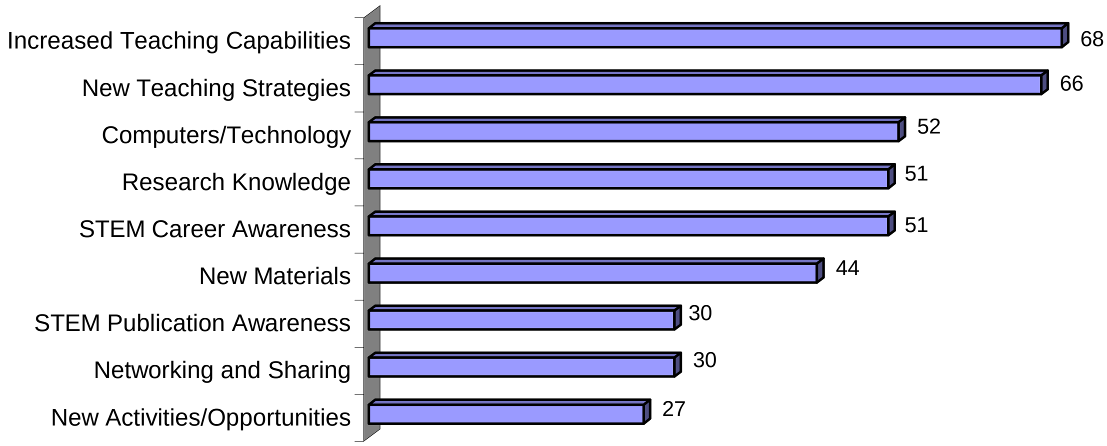
To make the scores of the various indices comparable, given that the indices were composed of different numbers of items, an individual's score was calculated as the percentage possible for that index, so that each index ranged from 0 (did none of the activities in that index) to 100 (did all of the activities in that index). The overall index score was then calculated as the mean of the individual scores.

Figure IV-1 shows the mean score for each outcomes index. Overall, the most widespread RET impacts were related to Increased Teaching Capabilities and New Teaching Strategies. The mean scores for these indices were 68 and 66, respectively, indicating that, on average, teachers experienced 68% or 66% of the various outcomes related to increased teaching capabilities and new teaching strategies. Least common outcomes related to STEM Publication Awareness (with a score of 30), Networking and Sharing (30), and New Activities/Opportunities (27).

[9] Because we wanted the respondent group to be the same for all items in the outcomes indices, only respondents who were teachers both before RET and at the time of the survey (n = 565) were included.

[10] The survey items comprising each index are presented in Appendix B.

Figure IV-1
2001-2005 ENG RET Outcomes Scores*



Sources: SRI International RET surveys, 2004 and 2006.

Respondent Descriptions of Most Important Project Outcomes[11]

Respondents were asked to describe what they thought was the single most important outcome of their participation in the RET Program. Broadly speaking, responses were consistent with the findings from the closed-ended questions about outcomes. For example, the largest category of responses described how RET enabled respondents to be better teachers.

> *RET provides a much-needed stimulus to individual teachers and helps generate a higher level of credibility for science and technology teachers.*
>
> *My work was in robotics—I have been able to bring very motivating activities to my inner-city students. It has challenged me to think of ways to incorporate STEM into the social studies classes that I teach.*
>
> *I have integrated topics related to electrical engineering into my classroom through many hands-on activities that make math enjoyable.*
>
> *I learned the importance of observing what knowledge and ideas students bring into the classroom and how to work with students to enhance it.*
>
> *Walked away with several curriculum units that I could use in my classroom, including one I had written throughout the RET program.*
>
> *I have become a more engaging and hands-on type of teacher.*
>
> *Obtaining the resources, confidence, and deeper understanding that I needed to teach physics in a very effective and intellectually stimulating way.*

---

[11] The questionnaire included two open-ended questions about effects of participants' RET experiences: one about program outcomes and another about impacts of the program on participants' students and school or school system. There was considerable overlap in the nature of the responses to these two questions. For simplicity of presentation, in this section we relate responses about the effects of the program on the teachers themselves; responses that refer explicitly to the participants' students or schools are summarized below, in the section titled "RET Impacts."

The ability to counsel my students as to the opportunities available in the real world and allow them the opportunity to simulate those activities in the high school classroom. So much more...

It gave me a renewed enthusiasm about the wonderful things science can accomplish, so I was more inspired to teach students science and encourage them to go on in science.

Comments about new STEM knowledge and the opportunity to learn about or, in some cases, do research also were common.

RET participation helps to keep me abreast of current research topics, methods, and techniques. It also helps to keep me aware of what my students face each day with my subject that has become second nature to me. So when I must struggle with material, while the profs and grad students treat it as common knowledge, I develop renewed empathy with the struggle my students face. Also, it helps to keep my brain sharp.

Awareness of the cross-disciplinary approach to nanotechnology studies.

I was able to see how exciting scientific research is, and couldn't wait to share all of the different aspects of biomedical engineering and bioinformatics with my students.

The most important outcome of my participation in the RET program was that I experienced the "scientific process" first hand and am better able to plan this learning process for my students.

The opportunity to experience engineering research was inspiring to me personally and energized me in the classroom.

I sincerely believe the RET program has exposed me to areas of STEM that I would NEVER have been involved in. This is exciting for me because I am learning along with my students. The excitement is contagious.

I think the single most important outcome of participation in RET was a better knowledge of how science is used in the real world, and how the STEM skills can be applied to problem solving in all areas of life.

Able to bring cutting-edge technology into the middle school environment to understand genetics and its real world application.

I was able to be a part of something significant--an ongoing research area that attempts to address real world problems.

Some described new contacts and networking or professional development opportunities.

From this experience I have copublished twice, regularly collaborate with area colleges, improved my courses, and instructed fellow K-12 teachers in the design process in our state curriculum frameworks.

The group of teachers working together on this project cemented their relationship as a team, allowing us to continue our collaborative work during the school year.

Connections to faculty and opportunities to show my students labs not available in high school.

The chance to begin networking with professionals in the STEM fields so I can enhance my teaching skills and resources.

Networking with local industry to help provide opportunities for other teachers and my students.

Connections with grad students and having them come to our school and work with our students.

Some described greater STEM education and career awareness.

It totally opened my eyes toward engineering. I had no idea how great it was before this experience. I have encouraged more of my students to choose engineering, science, and math for college majors than ever before.

The knowledge that I gained about what real engineers do on a daily basis. Having this knowledge I am able to mention careers more often when we are covering topics in my math class.

It made me more aware of some of the new STEM challenges on the horizon and more capable of exciting my students about STEM careers.

Seeing the connection between different areas of science and the economic opportunities available for students with advanced degrees in science and engineering.

Awareness of university opportunities and goals. I have a better idea of what universities are wanting from students and what expectations they have of the students.

Exposure to the skills that are required from STEM courses to go out and succeed in various STEM occupations is the single most important outcome to me. Now I can relay this information to my students.

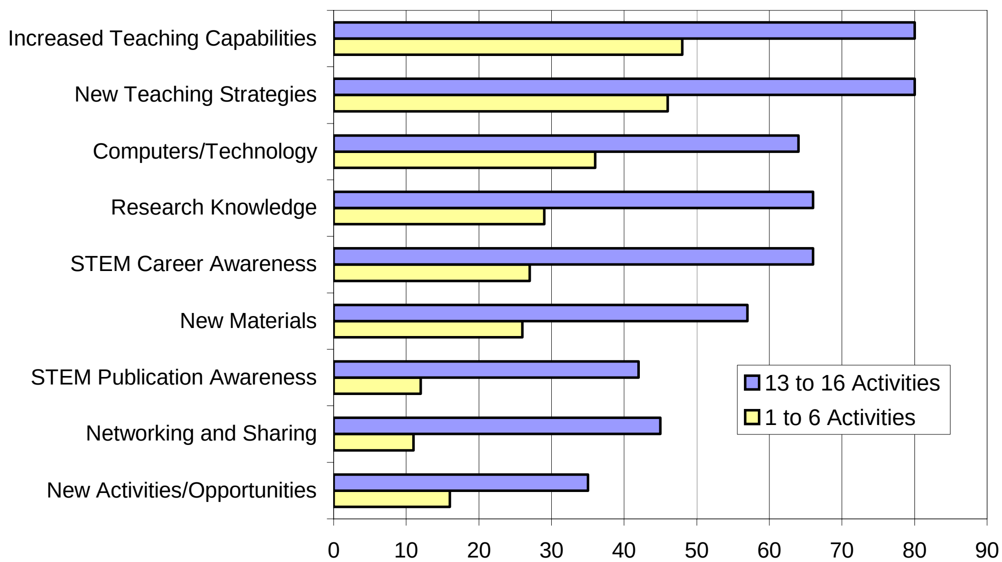
Key Correlates of Project Outcomes

As with participants' satisfaction with their RET experiences, project outcomes were strongly related to the variety of summer RET activities in which the participant engaged, the amount of follow-up interaction, and the project's relevance to the participant's classroom subjects. For all outcomes indices, mean scores progressed from lows among participants who reported no follow-up/few activities/low relevance to highs among those who reported a great deal of follow-up/many activities/high relevance. For most of the indices, the mean score differences between few activities and many activities were in the 30s,[12] the differences between not relevant and very relevant ranged from the 20s to the 40s, and the differences between no follow-up and a great deal of follow-up were mostly in the 20s.

The relationship between the outcome indices and the number of RET summer activities is shown in Figure IV-2. Outcomes most strongly related to number of activities were STEM Career Awareness and Research Knowledge. STEM Career Awareness mean scores ranged

[12] For instance, on New Teaching Strategies, the mean score of those with fewer than 7 activities was 46 and the mean of those with 13-16 activities was 80; the difference between these two means is 34.

Figure IV-2
2001-2005 ENG RET Outcome Scores,
by Number of Activities in Which RET Teachers Participated

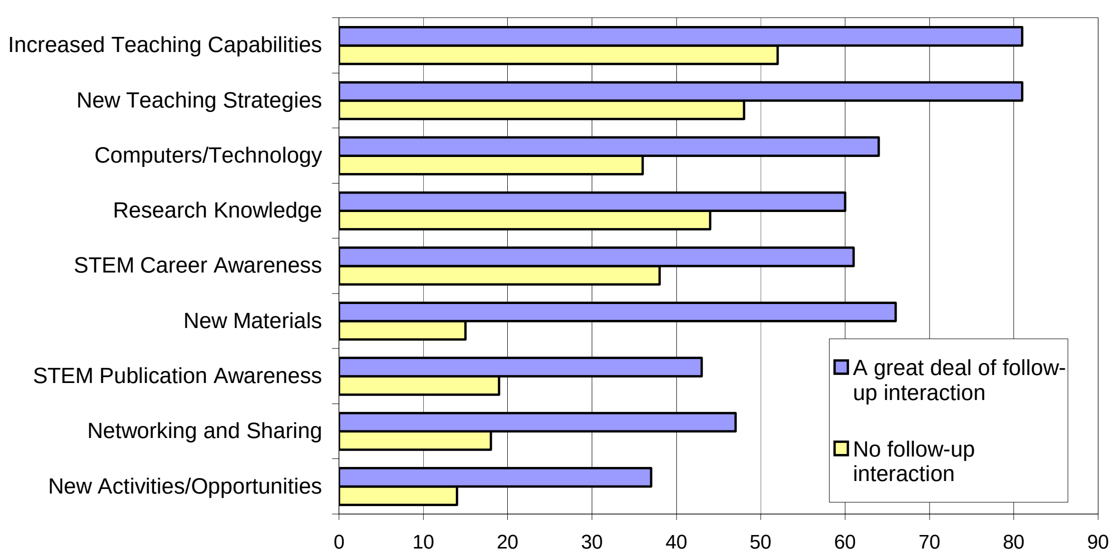


Sources: SRI International RET surveys, 2004 and 2006.

from 27 among participants who engaged in fewer than 7 activities to 66 among those who engaged in 13 to 16 activities. Research Knowledge ranged from 29 to 66.

Figure IV-3 shows the relationship between the outcome indices and the amount of follow-up interaction. By a considerable margin, the outcome most strongly related to follow-up was New Materials, the mean scores of which ranged from 15 among those who reported no follow-up to 66 among those who reported a great deal of follow-up. The next most strongly related was New Teaching Strategies, with means from 48 to 81.

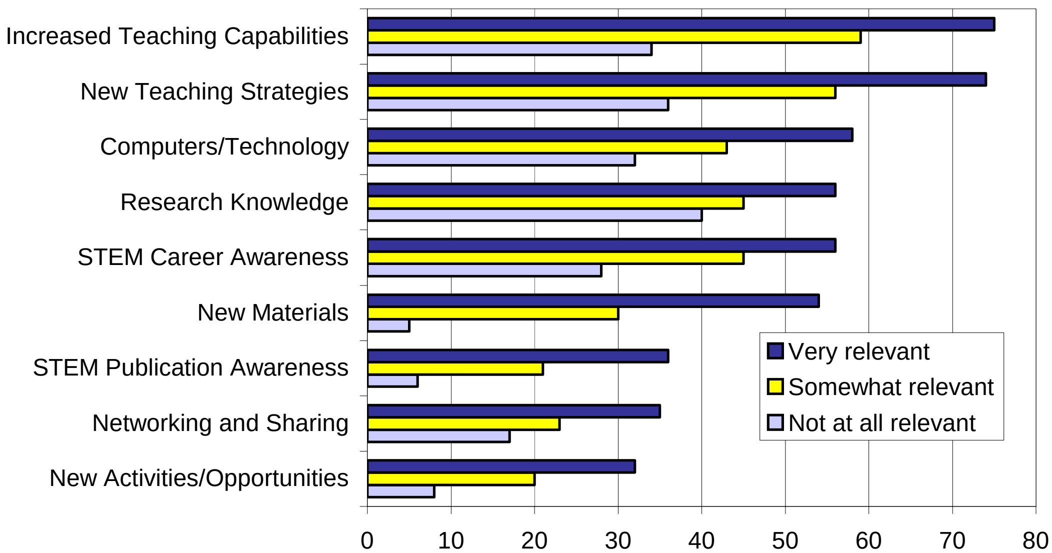
Figure IV-3
2001-2005 ENG RET Project Outcome Scores, by Amount of Follow-up Interaction



Sources: SRI International RET surveys, 2004 and 2006.

Figure IV-4 shows the relationship between the outcome indices and the relevance of RET summer activities to subjects taught by participants. New Materials was the index most strongly related to relevance, with means from 5, among those who said their RET activities were not at all relevant in their classroom,[13] to 54, among those who said RET was very relevant. Increased Teaching Capabilities was the next most strongly related, with means from 34 to 75.

Figure IV-4
2001-2005 ENG RET Outcome Scores, by Relevance of Program Activities to Subjects Taught in the Classroom



Sources: SRI International RET surveys, 2004 and 2006.

Outcomes by Other Project, School, and Teacher Characteristics

In addition to the relationships discussed above, RET outcomes were analyzed by the following project, school, and teacher characteristics:

- Project characteristics
  - Type of RET award (Site vs. Supplement)
  - Year of survey (2004 vs. 2006)
  - Summer of RET participation (2001/2002 only, 2003 only, 2004 only, 2005 only, multi-summer)
  - Number of summers of RET participation (single-summer vs. multi-summer)
  - Total hours in project (<170, 170 to 230, 231 to 320, >320)
- School characteristics
  - School location (urban, suburban, rural)
  - School level (elementary/middle vs. high school)

[13] Only 21 individuals reported that their RET activities were not at all relevant to their classroom subjects, so the statistics based on this group should be interpreted with caution.

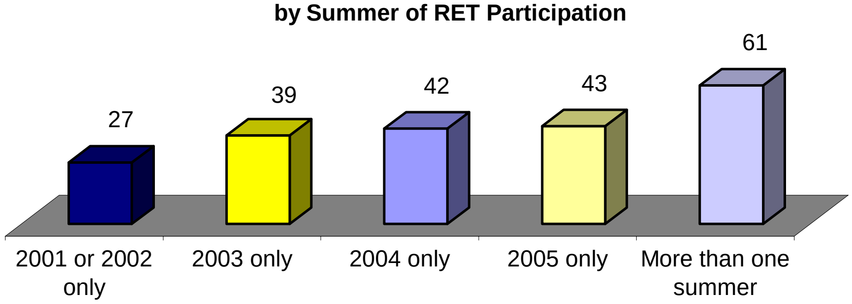
- Subsidized lunch program (50% or fewer vs. >50% of students receive reduced price/free lunch). (This measure is a proxy for low income students.)

- Teacher characteristics
  - Years teaching (10 or fewer vs. >10 years)
  - Relationship between academic degree and subjects taught (no STEM degree, no STEM disciplinary degree but STEM education degree, STEM disciplinary degree but not in subjects taught, STEM disciplinary degree in some but not all subjects taught, STEM disciplinary degree in all subjects taught)
  - Highest academic level completed (less than Master's, Master's, higher than Master's)
  - Age (<40 vs. 40+)
  - Gender

Of these characteristics, summer of project participation, number of summers of participation, and total hours were the only ones that were statistically reliably related to most or all of the outcome indices. The other characteristics tended to be related to only two or three indices, and the differences between high and low groups were very small.

The "summer of project participation" groups were reliably different from one another on all of the indices. Typically, those who participated only in 2001 or 2002 had the lowest scores and multi-summer participants had the highest scores. The differences were largest with regard to New Materials. On this index, mean scores ranged from 27 for those who participated only in 2001 or 2002 to 61 for those who participated for more than one summer (Figure IV-5).

Figure IV-5
2001-2005 ENG RET New Materials Scores, by Summer of RET Participation



Sources: SRI International RET surveys, 2004 and 2006.

On most of the indices, the differences between the highest and lowest means were in the teens. Differences between the combined single-summer groups and the multi-summer group were even smaller. Excluding the 2001/2002 group, multi-summer participation appeared to have little if any advantage over single-summer participation.

Total hours of RET participation were statistically reliably related to all outcome indices. For most of the indices, the difference between the low and high mean scores was in the teens. The indices most strongly related to hours of participation were New Materials, with scores ranging from 36 (those with fewer than 230 hours of participation) to 58 (those with more than 320 hours), and Research Knowledge, with scores from 42 (those with fewer than 170 hours) to 64 (those with more than 320 hours).

Relationships Between RET Activities and Outcomes

None of the individual RET summer project activities (listed in Table III-2, above) was very strongly related to most of the outcome indices. The activity with the strongest relationships was working on a plan to apply what was learned in RET to the classroom. Not surprisingly, this activity was most strongly related to New Teaching Strategies, Increased Teaching Capabilities, and New Materials. For example, those who worked on a classroom plan had a mean New Teaching Strategies score of 70, whereas those who did not work on a classroom plan had a mean of 44. Having done "no real research" was not particularly strongly related to outcomes but was very strongly related to satisfaction.

PROJECT IMPACTS

RET Impacts on Students

Respondents were asked how, if at all, any of their students had been affected by changes in the respondent's teaching following his/her RET experiences. Eight in ten respondents indicated that their participation resulted in one or more types of student effects. Most common were increased student awareness of STEM career options, more positive attitudes about STEM subjects in general, and greater interest in the respondent's classes (Table IV-2).

Table IV-2

2001-2005 ENG RET Teachers' Reports: Effects on Students from RET-Induced Changes in Participants' Instruction

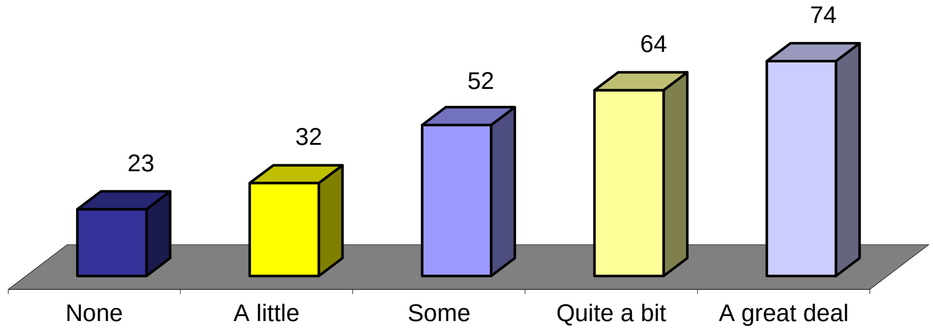
They have become more aware of STEM career options.	56%
They have more positive attitudes about STEM subjects in general.	52
They are more interested in my classes.	47
They have become more interested in STEM careers.	42
They are less intimidated by STEM subjects.	38
They are doing a better job of learning STEM subjects.	36
They have started/joined a STEM club.	11
They have participated in research at my RET institution.	9
None of the above/RET did not affect my teaching.	18

This table shows, for example, that 56% of RET teachers reported that their students have become more aware of STEM career options since the respondent participated in RET.

Sources: SRI International RET surveys, 2004 and 2006.

Broadly speaking, groups that tended to have high outcome scores were the ones most likely to report student impacts. Differences by number of RET summer activities and amount of follow-up interaction were especially large. Among these, most striking were the group differences in those who reported that their students had more positive attitudes about STEM. On the low end, 26% of those who engaged in fewer than 7 activities and 23% of those who reported no follow-up interaction said that their students had more positive attitudes. In contrast, 77% of those who engaged in 13 or more activities and 74% of those who reported a great deal of follow-up said their students had more positive attitudes. Figure IV-6 illustrates the relationship between follow-up and student attitudes.

Figure IV-6
Percentage of 2001-2005 ENG RET Participants Who Reported That, Since RET, Their Students Have More Positive Attitudes about STEM, by Amount of Follow-up Interaction



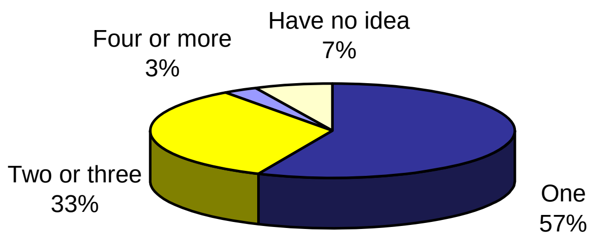
Sources: SRI International RET surveys, 2004 and 2006.

Partnerships Between K-14 Schools and Four-Year Colleges/Universities[14]

As stated in NSF's FY 2001 request for proposals, the Program's goal is to help build long-term collaborative relationships between K-14 teachers of science and mathematics and the NSF research community. To assess progress toward this goal, the 2004 survey asked whether partnerships to improve K-12 STEM education had been developed between the respondent's school or district and a college or university prior to the respondent's participation in RET or as a result of RET participation. Only about 3 in 10 respondents reported that a partnership had developed as a result of their RET participation or was likely to be developed in the future.

In preparation for the 2006 survey, SRI conducted a small number of interviews with respondents who had reported a partnership to explore what was taking place. Without exception, we found that the "partnership" was simply a personal relationship. Given the ambiguity of the term and the evident absence of formal partnerships, for the 2006 survey, we replaced the partnership question with questions about the numbers of past and future RET participants from the respondent's school—the rationale being that the long-term collaborative relationships envisioned by NSF require, at a minimum, the involvement of multiple participants.

Figure IV-7
Distribution of 2004-2005 ENG RET Participants, by Number of Individuals in Their School Who Have Participated in the RET Program



Sources: SRI International RET surveys, 2004 and 2006.

The 2006 survey found that even if RET partnerships or collaborative relationships are defined only as involving more than a single teacher, they are not very common. Slightly over half of the respondents said that they were the only person in their school who had participated in RET, a third said two or three individuals (including themselves) had been RET participants, only 3% said four or more individuals had participated, and 7% had no idea whether others had participated (Figure IV-7). About a third of the respondents (36%)

[14] RET research was conducted in commercial and non-profit organizations and federal research laboratories as well as in four-year colleges and universities. However, because the vast majority of ENG RET teachers worked in four-year colleges or universities, the questionnaire asked only about partnerships with colleges or universities.

reported that one or more individuals were likely to participate in RET in the coming summer (2006), but many (41%) had no idea if they or others would be participating.

Descriptions of Most Important RET Impacts on Students and Schools

Respondents were asked to describe what they thought was the most important impact, if any, that their participation in the RET Program had on their students or their school/school system. The most common responses related to increased student confidence, awareness, and interest in STEM topics and careers.

> *The credibility of a teacher who talks about science vs. one who has performed in a lab and experienced the "climate" of research cannot be compared. In addition, students are very perceptive and can sense the excitement in a teacher who talks about their research experience—in turn, that excitement tends to ignite fires of curiosity in many students, including some who never before saw science as interesting at all.*

> *Over the years, I have seen many students whose interest in science and mathematics is very acute in elementary grades and gradually dwindles as they progress into high school. RET, in my opinion, strives to provide teachers with a new set of "tools" to re-stimulate students' latent interests and rekindle their excitement.*

> *I think the single most important outcome of my participation in RET is that it allowed me to bring computer science into my classroom. I have young ladies in my room who are now thinking of an actual career in computer engineering, or any type of engineering for that matter.*

> *I think that the students now see science and research as something that is a possibility for them…The RET information and module allowed the topic to be less intimidating to them.*

> *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. I wound up teaching the activities to the other teams while they covered my classes. So instead of just reaching my students, I was able to connect with the entire eighth grade, approximately 400 students.*

> *The single most important outcome was bringing the world of engineering to some of my at-risk students. Engaging them in meaningful activities and watching them make connections to the mathematics they are learning was very rewarding. They appreciated the change of pace in the classroom, and I enjoyed teaching them something brand new.*

> *Until now, no one was recruiting future engineers at my school.*

> *I have several students who have changed their career goals based on what I brought back from the RET as well as what they gained through the research opportunities offered to them by the RET site where I participated.*

> *My students are better able to ask questions; they search for the answers and are confident enough to present their answers regardless of what they found.*

A number of respondents commented on increased hands-on and "real world" STEM experiences for their students or noted specific new materials or topics.

> *Students are motivated to learn new concepts when they are able to utilize technology and make connections to real-world applications.*
>
> *The completion of a project on bridge building. That encouraged several female students to consider engineering as a major.*
>
> *It allowed my students to work together in teams and work with their hands to accomplish a goal. They enjoyed the interaction with each other and were all able to complete a working device.*
>
> *My students now learn the scientific method by conducting their own scientific research in my classroom. Then they apply what they learn to develop solutions to environmental problems.*
>
> *Gave students an opportunity to, as they said, "be like real scientists."*
>
> *My students loved the interactive activities. It was very hands-on and they loved learning that way.*
>
> *My advanced placement students became involved in the research project I was involved in.*

For some, the new link or increased involvement with the RET institution or other colleges/ universities was the most important impact.

> *The experience of having a fellow come and work in my classroom on a weekly basis. The students are energized and welcome the activities we present to them with a new respect for where it might take them and how it is used in real life.*
>
> *The most important impact that RET had on my students was that they were able to go to the University and see some of the demonstrations and equipment in use. We also took our own samples down to be used on the equipment.*
>
> *We have been able to place high school students in research labs to work with RET faculty mentors.*
>
> *I now regularly collaborate with faculty and staff at three area colleges.*

In some cases, RET led to new programs or curricula.

> *We developed an independent research class for students. Students conduct their own independent research on a topic of their choice. The class has been very successful with winners in regional INTEL science and engineering fairs.*
>
> *It gave me background experience to become the science coordinator, which the school had never had before.*
>
> *Because there are limited materials and supplies at the school, I think that the grant writing skills and the information received on grants…was one of the most important impacts on my school. The materials to incorporate the research project into the classroom were also important for the students and the school. I think that ideas are great but having the resources to implement ideas are even better.*

I have brought a new science program centered around weather into my school, and from there into my district as a whole.

We are implementing a science program based much more in doing science than in reading about science. The RET program has helped me and worked with me to develop this plan.

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

OBSTACLES TO IMPLEMENTATION

Teachers were asked to rate each of nine potential obstacles in terms of how much of an obstacle it was to their ability to transfer what they learned in RET to their classroom (Table IV-3). The high cost of materials and equipment was overall the biggest obstacle, rated as a major obstacle by 35% of respondents and as a minor obstacle by 37%. The next biggest

Table IV-3

Obstacles to Transferring RET Knowledge to the Classroom Reported by 2001-2005 ENG RET Teachers (Listed in descending order of mean rating)

	n	Mean*	Not an Obstacle	A Minor Obstacle	A Major Obstacle	Have No Idea
Materials, equipment, etc. are too expensive	*554*	2.09	25%	37%	35%	3%
Not enough time on your part to prepare new lesson/lab plans, etc.	*556*	1.91	35	38	26	1
The level of the science is too high	*565*	1.69	47	34	17	2
Your school's curriculum is inflexible	*557*	1.65	52	29	18	2
Materials, equipment, etc. that you are planning to use are not yet available	*556*	1.62	51	24	16	10
The scientific topics are too different	*560*	1.62	50	33	13	3
Your school has poor/no access to computers/Internet	*559*	1.51	64	21	15	1
Other teachers or administrators at your school are resistant to your proposed changes	*554*	1.37	67	19	8	6
Not enough help from the RET team to make the research transferable (2006 survey only)	*351*	1.35	69	19	7	5

This table shows, for example, that 25% of respondents indicated that the expense of materials and equipment was not an obstacle to their ability to transfer what they learned in RET to their classroom.

*Based on a 3-point scale where 1 = not an obstacle, 2 = a minor obstacle, and 3 = a major obstacle.

Sources: SRI International RET surveys, 2004 and 2006 obstacle overall was not having enough time to prepare new lesson plans, rated as a major obstacle by 26% and a minor obstacle by 38%. Resistance by administrators or other teachers and not enough help from the RET team were the least common obstacles, with only 8% and 7%, respectively, rating each as a major obstacle. Encouragingly, the 2006 respondents tended to report fewer/smaller obstacles than did the 2004 respondents. In particular, the percentage who reported materials and equipment cost to be a major obstacle declined 15 percentage points, from 44% in 2004 to 29% in 2006.

To assess the relationship between obstacles and other study variables, we created an overall obstacles index by calculating each respondent's mean response to all nine potential obstacles. [15] Interestingly, there were not many relationships between obstacles and outcomes or follow-up interactions. However, obstacles were strongly related to the relevance of RET activities to the classroom. As one might expect, obstacles that were the most strongly related to relevance were that the level of science was too high and the scientific topics were too different. Obstacles also were strongly related to participants' satisfaction with their RET experiences. Among those who experienced few obstacles, 78% were very satisfied overall with their RET experiences; in contrast, only 45% of those who experienced many obstacles were very satisfied.

SUMMARY OF RET OUTCOMES AND IMPACTS

Participation in the RET Program served to increase almost all participants' STEM knowledge base, awareness of STEM research issues, motivation to find ways to improve student learning, and ability to convey the excitement of STEM to students. Almost all also reported positive effects on their students, the most common of which were increased awareness of STEM career options, more positive attitudes about STEM subjects in general, and more interest in the respondent's classes. However, it appeared that little progress was being made toward achieving NSF's goal of building long-term collaborative relationships between K-14 STEM teachers and the NSF research community: few teachers (19%) participated in the RET program for more than one year, and most were the only individual from their school to have participated; a mere 3% reported that as many as four individuals from their school had participated.

Participants who reported that the RET experience was very relevant to subjects they taught in the classroom were considerably more likely than those for whom the experience was only somewhat or not relevant to have reported diverse positive outcomes and effects on their students. Positive outcomes also were strongly related to the amount of follow-up interaction experienced, overall satisfaction with the experience, and the variety of project activities undertaken. However, excluding the 2001/2002 group—which tended to have lower outcome scores than single-summer participants in other years—multi-summer participation appeared to have little if any advantage over single-summer participation. There also were few appreciable relationships between school or participant characteristics and project outcomes. The most common obstacle to transferring what was learned in RET to the classroom was the expense of materials and equipment, but the percentages who experienced this and other implementation problems have declined since the early days of the Program.

[15] The index scores were divided into three groups, as follows: no/few obstacles = 1.0 to 1.39; some obstacles = 1.4 to 1.9; many obstacles = 2.0 to 3.0.

V. PARTICIPANT SUGGESTIONS FOR PROJECT/PROGRAM IMPROVEMENT

Approximately 4 in 10 respondents to the 2004 survey and about half of the respondents to the 2006 survey provided suggestions on how the RET Program or their RET projects might be improved.[16] Suggestions included greater attention to RET's relevance to the classroom; more support for classroom implementation; more or clearer information about project activities, objectives, and participant responsibilities; more or better interaction with mentors; more or less of different kinds of project activities; opportunities for continued involvement in the Program; and Program expansion. Examples follow.

Greater Attention to RET's Relevance to the Classroom

As much as possible, much prior matching of curriculum to research should be done.

I have participated in three RET programs, all in engineering. I teach biology and would have benefited more from a biology RET.

There seemed to be more relevance to science classes, and being a math teacher I found it difficult to apply a lot of the information to my own classes.

Since the focus of the program was to encourage more teachers to introduce modern physics in their curriculum, I would have liked to have seen the workshops specifically geared to creating labs/activities for the high school class.

Please consult high school teachers when planning these summer programs. Ask high school teachers what they need to help them in the classroom.

Would help if they would ask what area of research we might be interested in.

RET teachers should guide a group of teachers new to RET through the process and serve as mentors to the new teachers.

Most professors there did not have any familiarity with teaching at the public school level, thus making it difficult for them to translate their research into lessons or plans that can be used in the classroom.

More Support for Classroom Implementation

There should be a much stronger focus on how this material can be practically transferred to the classroom.

The proposed equipment and materials in the final project proposal should be provided to the concerned teacher, if NSF is really serious in transferring the RET program to the classrooms.

[The program has to outline] how the research is going to be utilized in a classroom structure for high school students.

[16] These counts do not include suggestions for improving the project orientation meetings and materials, discussed in Chapter III.

Meet with previous participants to hear of their experience and how they used their experience in the classroom.

Provide resources to implement the activities that teachers develop and continue to support them as they continue to use those activities. Otherwise, teachers are the only ones to benefit from the experience and not the students and school.

More communication with the classroom teacher during the school year to help the teacher come up with simple and interesting applications.

I think RET should provide more support post-summer. They need to organize more activity days that teachers can bring their students to.

Participants need to have year-round contact with professors/mentors and access to facilities.

Monthly or bimonthly meetings during the school year to keep up the progress.

More or Clearer Information about Project Activities, Objectives, and Participant Responsibilities

Better and timely communication with urban public schools to recruit more teachers of large minority urban schools.

Better organize the summer program. Too much time wasted waiting for an administrator/mentor to make a decision before programs could proceed.

The program goals and the individual goals for the participants must be more strongly linked.

More of an explanation of what it truly is all about.

More or Better Interaction with Mentors

Better communication between busy professors and intimidated teachers. Establish specific work times and expectations.

My mentor was not around a lot and did not provide clear training for me; the graduate students did not have time or were not interested in training me, so I was often left with things that I did not understand.

The program would have a much higher quality if only professors who were truly committed to mentoring participated.

The RET people need to be friendlier and treat us as professionals.

[Having] a lead teacher with experience in place to work with newer participants would be an excellent idea for a go-between.

More or Less of Different Kinds of Project Activities

Spend more of our on-site time collaborating on curriculum development.

The time allotted to research activities and how they could be used in the classroom could be enhanced.

Have teachers actively participate in real research.

Give us more opportunity to interact and integrate with research team members, and pull us out of the lab and research environment less often for "herd" experiences.

Bigger supplies budget based on lesson development for the classroom.

More time on a weekly basis for the RET's to meet and discuss their individual projects.

Get rid of the poster project; it seems to me a waste of valuable time that could be used for lesson creation.

Opportunities for Continued Involvement in the Program

Teachers engaged in RET programs should be allowed to extend their programs for another year to get a full grasp on the subjects.

I would enjoy workshops for past RET fellows during the school year or other opportunities to continue to increase my STEM knowledge/awareness. Summer courses designed for teachers of science would be an even better way to keep learning.

I did my RET in the summer of 2002. I would have liked to be able to continue with this training and experiences in the following summers but I was not contacted and was not able to do it again, even though I would have done it in a minute.

I would strongly recommend making the experience a two-summer experience. This allows the teachers to really feel like they can accomplish something in that second summer.

I would love to have an opportunity to do a summer RET experience again in the same area and keep learning more to take students to even higher learning.

I would allow certain teachers to return and continue work. Not only would they get a bunch out of a 2nd program, but they would really be helpful to the new RET Teachers.

Program Expansion

There are other schools that are on a year-round schedule as I am. Perhaps this program could be offered at various times throughout the year so other teachers can have this experience to increase their ability to participate in the lab of their choice and to get more teachers involved in STEM activities.

I think this would be an excellent program for high school students as well, and I would love to hear more about opportunities for teachers and high school students.

This is an excellent program and wish that more teachers could be given a similar opportunity.

I think that you should have a program for administrators/curriculum people as well as teachers. I also would like to see a program that follows up throughout the school year.

More teachers need to do it! More publicity! More colleges and universities buying into the program!

VI. RECOMMENDATIONS

The ENG RET Program has been effective in teaching K-14 STEM teachers more about STEM research and motivating them to convey their newfound enthusiasm to their students. Nevertheless, opportunities remain for enhancement. SRI's suggestions follow.

- One of SRI's most striking findings was the strong relationship between the amount of follow-up interaction and positive project outcomes. We recommend that NSF require that proposals describe a follow-up plan involving ongoing interaction that supports classroom implementation of lesson plans, curricula, or skills developed in the RET project. We also suggest that renewal proposals be encouraged to provide documentation of such follow-up in previous years.
- Not surprisingly, relevance to the classroom also was very important to participants' ability to use what they learned. We recommend that NSF encourage PIs to focus strongly on making the summer experience relevant to participants' K-14 classrooms. For example:
  - Select only those participants whose classroom subjects are directly related to the RET research area(s).
  - Pair teachers who teach at the same grade level.
  - Provide adequate time, financial support, and assistance to enable participants to translate their research experiences to their classrooms.
- Participants who engaged in a variety of activities during their summer projects tended to benefit more than those who engaged in only a few activities. At the same time, as noted above, it is important that activities be relevant to participants' classrooms. PIs thus should be encouraged to include a variety of activities in their summer projects, all of which work toward helping participants' ultimate need to translate what they have learned to their own classrooms.
- The long-term collaborative relationships that NSF states are a goal appear rare, and there is little in the Program announcements about how PIs can meet this goal. Some of the above suggestions for making individuals' experiences more powerful also would tend to facilitate ongoing relationships. In addition, NSF should consider encouraging PIs to recruit participants from the same schools/school districts (preferably in low-income areas) over multiple years.
- Respondents to the 2006 survey appeared to have a greater awareness and understanding of the RET Program than did those who responded to the 2004 survey, but there were still a few who were not aware that they were participating in RET. We suggest that NSF prepare a simple brochure about the Program's objectives and components and request that RET PIs distribute it to all RET applicants.

APPENDIX A

SURVEY QUESTIONNAIRE WITH TOPLINE RESULTS

NATIONAL SCIENCE FOUNDATION
DIRECTORATE FOR ENGINEERING
RESEARCH EXPERIENCES FOR TEACHERS (RET) PROGRAM
Combined 2004 & 2006 Surveys

[Variable numbers used in Appendix C tabulations are shown in parentheses]

Overview of Your RET Experiences

1. (Q1) In what summers have you participated in the RET Program?
(PLEASE SELECT ALL THAT APPLY) (n = 631)

Summer, 2001	7%	Summer 2001 only	4%
Summer, 2002	14	Summer 2002 only	8
Summer, 2003	28	Summer 2003 only	21
Summer, 2004	28	Summer 2004 only	16
Summer, 2005	42	Summer 2005 only	32
Any summers **before** 2004	46	More than one summer	19

If you have participated in RET for only <u>one</u> summer, please skip to question 3.

2. (Q2) (If you participated in RET for more than one summer:) Did you participate in the **same** RET project for two or more summers, or did you spend both/all summers in different RET projects?
(PLEASE SELECT ONE RESPONSE) (n = 110)

I participated in the same RET project for two or more summers............ 49%

I spent both/all summers in different RET projects.................................. 51

3. (N3) As far as you know, have others in your school (besides you) participated in the RET program, either the same year(s) that you participated or in other years? **(PLEASE SELECT ONE RESPONSE)**
(2006 survey only; n = 393)

Yes........................... 38%

No 56

Have no idea 6

4. (N4) As far as you know, how many in your school **(including you)** have participated in the RET program?
(PLEASE SELECT YOUR BEST ESTIMATE) (2006 survey only; n = 392)

One	Two or three	Four or more	Have no idea
56%	33%	3%	7%

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Expiration: 7/31/2007

5. (Q20) As far as you know now, will you be participating in RET this coming summer? **(PLEASE SELECT ONE RESPONSE) (2006 survey only; n = 389)**

Yes, in a continuation of the project I have been in	11%	→ ***Please skip to question 7***
Yes, but in a different RET project than I have been in .	4	
Maybe, not sure yet..	33	
No	52	

6. (Q21) If it were possible, would you *like* to return to the same RET project this coming summer for a continuation of your previous RET work there? **(PLEASE SELECT ONE RESPONSE) (2006 survey only; n = 343)**

No, definitely not	6%
No, probably not	17
Yes, probably	27
Yes, definitely	46
Have no idea......................	4

7. (N7) As far as you know, will **others** in your school be participating in the RET program this coming summer? **(PLEASE SELECT ONE RESPONSE) (2006 survey only; n = 394)**

Yes	9%
Maybe, not sure yet......	27
No	39
Have no idea	25

8. (N8) As far as you know, how many in your school **(including you)** are likely to participate in the RET program this coming summer? **(PLEASE SELECT YOUR BEST ESTIMATE) (2006 survey only; n = 390)**

None	One	Two or three	Four or more	Have no idea
23%	21%	14%	1%	41%

9. (Q3) At which of the following locations did your **summer** RET-sponsored activities take place? **(PLEASE SELECT ALL THAT APPLY) (n = 627)**

4-year college or university..............................	89%
For-profit company	7
Hospital, clinic, or medical research facility....	5
Non-profit research organization	1
U.S. government lab..	3
Other location...	2
(2006 survey only; n = 394)	
My school..	6
My home	7

Prior to Your RET Experience

10. (Q4) **Before the first summer** of your RET experiences, did you do any of the following? **(PLEASE SELECT ONE RESPONSE IN EACH ROW)**

Before the first summer, did you…	***n***	**Yes**	**No**	**Don't remember**
Receive materials describing the RET work you would be doing?	*620*	64%	31%	5%
Meet in-person to discuss the upcoming summer activities with your RET mentor/program manager?	*618*	58	41	2
Talk on the phone or exchange e-mails about the upcoming summer activities with your RET mentor/program manager?	*627*	85	14	2

11. (Q5) **At the start** of your first RET summer project, did you attend any kind of in-person individual or group orientation session? **(PLEASE SELECT ONE RESPONSE) (n = 629)**

Yes	No	Don't remember
87%	11%	2%

12. (Q6) When you started work during your first RET summer, how well informed do you feel you were about each of the following? **(PLEASE SELECT ONE RESPONSE IN EACH ROW)** **[Listed in descending order of mean rating]**

	N	**Mean**	**Not at all informed**	**Somewhat informed**	**Pretty well informed**	**Very well informed**	**Don't remember**
Program logistics (locations of activities, parking, meals, administrative issues, etc.)	*629*	3.56	2%	8%	21%	67%	1%
The scheduled activities for the summer	*628*	3.40	3	13	25	59	1
The overall RET program objectives/goals	*631*	3.30	3	17	28	52	1
The objectives/goals of your RET summer project	*628*	3.26	3	18	27	51	1
What you were expected to do/accomplish during the summer	*629*	3.23	3	18	31	47	1

13. (Q7) How do you think the preparatory information, meetings, or orientation session could be improved, if at all? **(PLEASE BE AS SPECIFIC AS POSSIBLE)**
(341 responses)

RET Summer Activities

14. (Q8) Which of the following did you do as part of any of your **summer RET experiences**? **(PLEASE SELECT ALL THAT APPLY) (n = 629) [Listed in descending order of mean rating]**

As part of my summer RET experiences, I:

Worked on a plan for applying aspects of what I learned in RET to my classroom teaching	84%
Observed research activities performed by researchers/faculty at the host institution	82
Worked on developing curricula/lesson plans for my classroom	79
Prepared/delivered a poster presentation, written report, or oral presentation describing my RET accomplishments to other RET participants, my mentor, etc.	77
Read academic literature, journal articles, etc	77
Practiced using scientific equipment or specific scientific procedures	76
Attended demonstrations of the use of scientific equipment or specific scientific procedures	72
Attended lectures about current STEM topics/techniques	71
Did Internet searches on issues related to translating STEM topics to the classroom	67
Assisted faculty/researchers with their research	63
Went on research-related field trips (to other labs on- or off-campus, industry research sites, outdoor research sites, etc.)	56
Collected and/or analyzed data or information to try to answer a STEM research question	51
Attended lectures/demonstrations/workshops about strategies for teaching STEM concepts	46
Received formal or informal training in technical writing/presentation skills	46
Worked on a STEM research project for which I had major responsibility	41
Did little or nothing that seemed to me to be real research	7
Other major RET summer activities	6

Mean number of activities selected (excluding "did little or nothing that seemed to me to be real research): 10 of 16 listed.

14. (Q9) Were you housed on/near the RET host institution for your summer RET activities, or did you commute from your home? **(PLEASE SELECT ONE RESPONSE FOR EACH APPLICABLE YEAR)**

	n	**Housed on/near host institution**	**Commuted**	**Some of both**
Summer, 2001	*46*	17%	76%	7%
Summer, 2002	*87*	9	79	11
Summer, 2003	*173*	10	88	2
Summer, 2004	*176*	9	89	2
Summer, 2005	*266*	11	87	2
ALL SUMMERS	*628*	11	85	4

16. (Q10) For how many weeks did your RET summer activities last?
(PLEASE ENTER YOUR BEST ESTIMATE FOR EACH APPLICABLE YEAR)

	n	Mean	Min.	Max.	1-2 weeks	3-4 weeks	5-6 weeks	7+ weeks
Number of weeks in summer, 2001	*47*	6.00	2	16	2%	34%	34%	30%
Number of weeks in summer, 2002	*86*	6.59	2	16	2	12	49	37
Number of weeks in summer, 2003	*176*	6.22	2	15	1	25	41	32
Number of weeks in summer, 2004	*175*	6.63	2	16	7	9	42	43
Number of weeks in summer, 2005	*261*	6.38	2	14	6	10	47	37
OVERALL	*625*	6.43	2	16	4	15	44	38

17. (Q11) On average, about how many hours per week did you spend on RET activities each summer that you participated in the RET program? **(PLEASE ENTER YOUR BEST ESTIMATE FOR EACH APPLICABLE YEAR)**

	n	Mean	Min.	Max.	<21 hrs/wk	21-39 hrs/wk	40 hrs/wk	>40 hrs/wk
Hours/week in summer, 2001	*46*	35	4	56	17%	17%	48%	17%
Hours/week in summer, 2002	*82*	35	3	60	13	30	44	12
Hours/week in summer, 2003	*172*	33	3	60	18	30	40	12
Hours/week in summer, 2004	*174*	34	3	60	14	35	41	10
Hours/week in summer, 2005	*261*	35	2	60	15	26	44	15
OVERALL	*617*	35	2	60	15	28	43	14

Total hours spent on RET activities (week * hours)

	n	Mean	Min.	Max.
Hours in summer, 2001	*46*	203	32	450
Hours in summer, 2002	*82*	221	20	560
Hours in summer, 2003	*172*	203	15	600
Hours in summer, 2004	*173*	220	24	480
Hours in summer, 2005	*257*	222	8	500
OVERALL	*589*	256	8	1350

18. (Q12) **During the academic year after your RET summer(s)**, how much interaction, if any, did you have with your RET mentor or others who were part of your summer RET experiences? *Please include e-mails, telephone conversations, in-person meetings, etc.*
(PLEASE SELECT ONE RESPONSE FOR EACH APPLICABLE YEAR)

			How much interaction:				
	n	**Mean**	**None**	**A little**	**Some**	**Quite a bit**	**A great deal**
Academic year following 2001 summer	*47*	2.89	15%	28%	23%	21%	13%
Academic year following 2002 summer	*83*	3.11	12	20	28	24	16
Academic year following 2003 summer	*174*	3.13	10	21	29	26	14
Academic year following 2004 summer	*177*	3.33	8	19	29	22	23
Academic year following 2005 summer	*266*	3.20	9	19	31	27	15
MAX INTERACTION	*626*	3.14	11	20	30	25	15

Your Assessments of Your RET Experiences

19. (Q13) Overall, how did you feel about the amount of each of the following during your **summer RET activities**? **(PLEASE SELECT ONE RESPONSE IN EACH ROW)**
[Listed in descending order of "about the right amount"]

	n	**Mean**	**Too little**	**About the right amount**	**Too much**
Your summer RET work load overall	*624*	2.00	4%	92%	4%
The amount of time you spent attending lectures, workshops, demonstrations, and meetings	*625*	1.99	9	84	7
The amount of time you spent on hands-on research activities	*627*	1.85	19	78	4
The amount of time you spent on curriculum development or translating research experiences to the classroom	*630*	1.78	25	73	3

20. (Q14) Considering your own needs, interests, time constraints, etc., how many weeks would you like your RET summer activities to have lasted?
(PLEASE ENTER YOUR BEST ESTIMATE FOR EACH APPLICABLE YEAR)

	n	Mean	Min.	Max.	1-2 weeks	3-4 weeks	5-6 weeks	7+ weeks
Preferred number of weeks in summer, 2001	*47*	6.11	3	16	0%	23%	45%	32%
Preferred number of weeks in summer, 2002	*85*	6.31	2	14	2	26	35	36
Preferred number of weeks in summer, 2003	*169*	5.93	2	14	1	36	33	30
Preferred number of weeks in summer, 2004	*167*	6.17	2	14	5	18	41	36
Preferred number of weeks in summer, 2005	*258*	6.02	2	12	5	20	44	31
OVERALL	*609*	6.02	2	16	4	25	39	32

21. (Q15) Overall, how relevant were your RET activities to the subjects you currently teach?
(PLEASE SELECT ONE RESPONSE) (n = 629)

Not at all relevant....................................... 3%
Somewhat relevant..................................... 32
Very relevant 56
Doesn't apply: I am not now a teacher ..... 9 → ***Please skip to question 24***

22. (Q16) For each of the following, please indicate:
If your RET activities addressed it at all and, if yes,
How much RET increased your awareness? **(PLEASE SELECT ALL THAT APPLY)**
[Responses have been converted to a single scale; listed in descending order of mean rating]

	How much awareness increased				
	n	Mean	None	Some	A lot
Current science, technology, engineering, or mathematics (STEM) research issues	*558*	2.36	11%	42%	47%
New materials/equipment (other than computers) that could be useful to you as a teacher	*562*	2.09	23	45	32
STEM career options	*554*	1.92	35	38	27
How to use computers more effectively in your teaching	*563*	1.88	37	39	24
Magazines/professional journals that could be useful to you as a teacher	*565*	1.62	51	36	13

23. (Q18) To what extent, if at all, do you think your RET experiences increased **your …**
(PLEASE SELECT ONE RESPONSE IN EACH ROW) [Listed in descending order of mean rating]

	n	**Mean**	**No increase**	**Increased some**	**Increased a lot**	**Have no idea**
…general knowledge base in science, technology, engineering, or mathematics (STEM)	*572*	2.58	2%	38%	60%	0%
…motivation to find ways to improve your students' learning	*570*	2.55	5	34	60	<1
…ability to convey the excitement/ vitality of STEM to students	*566*	2.48	7	37	55	1
…confidence in your ability as a STEM teacher generally	*569*	2.41	9	39	50	1
…professional opportunities	*568*	2.25	16	43	40	1
…skills in using the Internet to obtain information that will be helpful to your teaching	*569*	1.91	31	47	22	0

24. (Q17) For each of the following, please indicate:
If your RET activities addressed it at all and, if yes,
How much RET increased your understanding? **(PLEASE SELECT ALL THAT APPLY)**
[Responses have been converted to a single scale; listed in descending order of mean rating]

			How much understanding increased		
	n	**Mean**	**None**	**Some**	**A lot**
STEM applications in everyday life	*611*	2.16	20%	44%	36%
How to conduct a research project	*613*	2.11	21	48	31
How scientific knowledge is built	*611*	2.07	23	47	30
How to deal with research setbacks, frustration, "negative results," etc.	*617*	1.99	29	43	28
Ethical dimensions of STEM research	*610*	1.78	42	38	20

25. (Q19) How dissatisfied or satisfied were you with each of the following aspects of your RET experience? **(PLEASE SELECT ONE RESPONSE IN EACH ROW) [Listed in descending order of mean rating]**

	N	**Mean**	**Very dissatisfied**	**Somewhat dissatisfied**	**Somewhat satisfied**	**Very satisfied**	**Doesn't apply**
The adequacy of your stipend	*630*	3.79	<1%	2%	16%	81%	1%
The helpfulness of the RET staff	*629*	3.73	2	3	15	79	1
The experience as a whole	*627*	3.73	1	3	17	78	<1
The helpfulness of graduate students and postdocs	*629*	3.72	1	3	15	70	11
The timeliness of your paychecks	*629*	3.65	3	5	15	76	1
Your relationship with your mentor, overall	*629*	3.63	4	4	17	74	1
How well organized the summer activities were	*625*	3.56	3	6	23	67	1
Your opportunity to interact and discuss STEM issues with other teachers during the summer program	*626*	3.55	3	6	21	63	7
The relevance of your RET experience to the subjects you teach	*629*	3.50	3	6	28	61	1
The amount of interaction you had with your mentor (**2006 survey only)**	*393*	3.49	4	7	24	65	1
Your opportunity to interact and discuss STEM issues with faculty/researchers	*627*	3.45	3	9	24	58	5
Your mentor's knowledge of the roles/responsibilities of K-12 STEM teachers	*629*	3.40	5	8	27	56	4
Your mentor's interest in helping you develop a plan to transfer what you learned to your classroom	*629*	3.39	5	9	25	57	4
The extent to which you felt that you were an integral part of a research team	*630*	3.25	7	12	29	50	3

RET Outcomes and Impacts

26. (Q22) What was your occupation **immediately before you first participated in RET**?
(PLEASE SELECT ALL THAT APPLY) (n = 630)

Teacher/Faculty member	96%
School administrator	1
Curriculum specialist	3
Student	4
Other	1

27. (Q24) What is your **current** occupation? **(PLEASE SELECT ALL THAT APPLY) (n = 629)**

Teacher/Faculty member	91%
School administrator	3
Curriculum specialist	3
Student	4
Unemployed	1
Retired	1
Other	3

IMPORTANT INSTRUCTIONS:

If you are currently a teacher and were a teacher before you participated in RET	→ ***Please continue***
If you are currently a teacher but were NOT a teacher before you participated in RET	→ ***Please skip to question 31***
If you are NOT currently a teacher	→ ***Please skip to question 39***

[QUESTIONS 28-30 ARE ONLY FOR THOSE WHO WERE TEACHERS BEFORE RET AND STILL ARE TEACHERS]

28. (Q25) For each of the following, please indicate:
If you have done this since participating in RET and, if yes,
Whether your post-RET use is less, the same amount, or more than your pre-RET use?
(PLEASE SELECT ALL THAT APPLY)
[Responses have been converted to a single scale; listed in descending order of mean rating]

	n	**Mean**	**Less now**	**Same**	**More now**
Talked with or counseled students about careers in science, technology, engineering, or mathematics (STEM) fields	*533*	2.61	1%	38%	62%
Encouraged students to access the Internet to learn more about STEM topics	*530*	2.39	0	61	39
Read scientific/engineering journal articles	*526*	2.31	1	68	31
Became involved in STEM-related extracurricular activities (for example, school science club)	*531*	2.28	1	70	29

29. (Q26) For each of the following instructional strategies for STEM subjects, please indicate: If your participation in RET has affected how much you use this strategy and, if yes, Whether your post-RET use is less or more than your pre-RET use?
(PLEASE SELECT ALL THAT APPLY)
[Responses have been converted to a single scale; listed in descending order of mean rating]

	n	**Mean**	**Less now**	**No effect**	**More now**
Tell students about or use new technologies	*520*	2.80	2%	17%	82%
Assign projects based on “real world” problems	*528*	2.78	<1	21	79
Integrate math, science, and technology	*524*	2.76	1	23	77
Use hands-on activities in your classroom	*533*	2.70	<1	30	70
Assign joint or group projects	*528*	2.60	1	39	61
Use computers	*527*	2.59	2	36	62
Require oral presentations or written reports	*528*	2.55	1	43	56
Take students on field trips to research labs/facilities	*531*	2.31	3	63	34

30. (Q27) In which of the following ways, if any, have any of your students been affected by changes in your teaching following your RET experiences? **(PLEASE SELECT ALL THAT APPLY) (n = 543)**

Doesn’t apply to me: RET did not change my teaching 13%

[Listed in descending order:]

They have become more aware of STEM careers options 56%
They have more positive attitudes about STEM subjects in general 52
They are more interested in my classes 47
They have become more interested in STEM careers 42
They are less intimidated by STEM subjects.. 38
They are doing a better job of learning STEM subjects 36
They have started/joined a STEM club... 11
They have participated in research at my RET institution........................ 9
None of the above 5

31. (Q29) Which of the following have happened since you began your RET experiences? **(PLEASE SELECT ALL THAT APPLY) (n = 564) [Listed in descending order]**

I included examples or applications from my RET activities in my teaching	82%
I acquired new skills in RET that I was able to use in my classroom	66
I have implemented in my classroom curricula/lesson plans that I developed as part of my RET activities	63
I received materials, supplies, or equipment from my RET institution that I have been able to use in my classroom	50
I have shared RET-derived information, materials, or other resources with other teachers in my school/district	48
During the academic year(s), I have received announcements of workshops or other professional development activities from my RET mentor or others at my RET institution **(2006 survey only; n=359)**	40
I used contacts or experiences from RET to obtain new resources for my classroom	38
During the academic year(s), I have networked with other RET teachers about teaching or other professional issues	33
During the academic year(s), I have discussed classroom implementation issues with my RET mentor or others at my RET institution **(2006 survey only; n=359)**	31
As a result of my RET experiences, I began teaching additional/different subjects than I did before my RET experiences	28
My students or I have had access to facilities or equipment at the RET institution **(2006 survey only; n=359)**	22
Faculty/researcher(s) from my RET institution came to my school to meet with my students (gave presentations, counseled about careers, etc.)	21
As a result of my RET experiences, I assumed new leadership roles or responsibilities in my school/district/region	19
I took students to my RET college/university	15
I have organized/facilitated in-service workshops for other teachers/school personnel on issues related to my RET experiences	15
As a result of my RET experiences, I changed jobs	1
None of the above	6

32. (Q32) How much of an obstacle, if any, has each of the following been to your ability to transfer what you learned in RET to your classroom(s)? **(PLEASE SELECT ONE RESPONSE IN EACH ROW)**
[Listed in descending order of mean rating]

	n	**Mean**	**Not an obstacle**	**A minor obstacle**	**A major obstacle**	**Have no idea**
Materials, equipment, etc. are too expensive	*554*	2.09	25%	37%	35%	3%
Not enough time on your part to prepare new lesson/lab plans, etc.	*556*	1.91	35	38	26	1
The level of the science is too high	*565*	1.69	47	34	17	2
Your school's curriculum is inflexible	*557*	1.65	52	29	18	2
Materials, equipment, etc. that you are planning to use are not yet available	*556*	1.62	51	24	16	10
The scientific topics are too different	*560*	1.62	50	33	13	3
Your school has poor/no access to computers/Internet	*559*	1.51	64	21	15	1
Other teachers or administrators at your school are resistant to your proposed changes	*554*	1.37	67	19	8	6
Not enough help from the RET team to make the research transferable **(2006 survey only)**	*351*	1.35	69	19	7	5

33. (Q34) What subject(s) do you teach? **(PLEASE SELECT ALL THAT APPLY) (n = 565)**
[Listed in descending order]

Physics	30%
Biology	27
Chemistry	27
Mathematics	26
Earth/environmental science	19
General/integrative science	17
Technology education	12
Engineering	9
Non-STEM subjects	8
Computer science	4
Robotics	3
Life science	2

34. (Q35) Which of the following best describes the level of the school at which you work? **(PLEASE SELECT ONE RESPONSE) (n = 566)**

Elementary	7%
Junior high/middle school	22
High school	66
Two-year college	3 → ***Please skip to question 39***
Other	1

35. (Q36) By which of the following types of schools are you currently employed? **(PLEASE SELECT ONE RESPONSE) (n = 549)**

Public district school (<u>not</u> a magnet school)	78%
Public magnet school	14
Private school	6
Other	2

35. (Q37) Which of the following best describes your school's location? **(PLEASE SELECT ONE RESPONSE) (n = 547)**

Urban	45%
Suburban	40
Rural	15

37. (Q38) Approximately what percentage of the student body of your school is eligible for a free or reduced price lunch? **(PLEASE SELECT YOUR BEST ESTIMATE) (n = 549)**

Fewer than 25%	26%
25% to 49%	27
50% to 74%	16
75% or more	23
Have no idea	8

38. (Q33) As far as you know, approximately what percentage of your students have access to the Internet **at home**? **(PLEASE SELECT YOUR BEST ESTIMATE) (n = 547)**

Fewer than 25%	15%
25% to 49%	19
50% to 74%	25
75% or more	34
Have no idea	7

39. (Q40) For how many years have you been (or were you) a teacher?
(PLEASE ENTER YOUR BEST ESTIMATE) (n = 599)

1 to 5 years	25%
6 to 10 years	26
11 to 15 years	19
16 to 20 years	11
More than 20 years	19
Mean	12.6
Minimum	1
Maximum	40

40. (Q41) Since you began your participation in RET, have you enrolled in any teacher education or STEM courses, certificate programs, certification programs, or degree programs?
(PLEASE SELECT ALL THAT APPLY IN EACH COLUMN) (n = 564)

	Teacher Education	STEM
Course	21%	10%
Certificate program	6	1
Certification program	7	2
Degree program	15	4
None of the above	65	87

Background Information

40. (Q42) What is the highest level of education that you have completed?
(PLEASE SELECT ONE RESPONSE) (n = 629)

Bachelor’s degree	14%
Graduate work but no advanced degree	20
Masters	31
Post-Masters work but no doctorate	26
EdD	1
PhD	6
Other	2

42. (Q43) Please indicate below the field(s) in which you have received your degree(s), as applicable.
[Listed in descending order for each type of degree]

A. Undergraduate major(s): **(n = 603)**

Life science	29%
Physical/earth science	14
Education (general)	13
STEM education	13
Chemistry	12
Math	10
Social science	9
Engineering/technology	8
Science (general)	2
Other	12

B. Master's: **(n = 392)**

Education (general)	45%
STEM education	24
Life science	9
Physical/earth science	7
Engineering/technology	7
Chemistry	4
Math	3
Social science	3
Science (general)	1
Other	8

C. PhD: **(n = 47)**

Chemistry	21%
Life science	19
Education (general)	17
Engineering/technology	15
Physical/earth science	11
STEM education	9
Math	4
Social science	4
Science (general)	0
Other	2

D. Other graduate work: **(n = 144)**

Education (general)	40%
Life science	20
STEM education	15
Physical/earth science	12
Engineering/technology	8
Chemistry	3
Math	3
Science (general)	3
Social science	2
Other	10

Note: The following information will help us interpret your responses to the previous questions. **All** your responses are **voluntary and strictly confidential**. No one outside the project staff at SRI will ever see your individual responses to any of the questions.

43. (Q44) What is your age? **(PLEASE SELECT ONE RESPONSE) (n = 622)**

Under 30 ....16%
30 to 39 30
40 to 49 25
50 to 59 25
60 to 69 4
70 or older.......... 0

44. (Q45) What is your gender? **(PLEASE SELECT ONE RESPONSE) (n = 631)**

Male 52%
Female.......... 48

45. (Q46) What is your race/ethnicity? **(PLEASE SELECT ALL THAT APPLY) (n = 619)**

American Indian or Alaskan Native	1%
Asian	5
Black or African American	13
Hispanic or Latino	6
Native Hawaiian or Pacific Islander	<1
White	77
Other	0

46. (Q47) What do you think was the single most important outcome of your participation in the RET program?
606 responses

47. (Q48) What do you think was the most important impact, if any, that your participation in the RET program had on your students or your school/school system?
567 responses

48. (Q49) If you have any suggestions for improving the RET program as a whole, please provide them here.
286 responses

49. (Q50) Other comments.
194 responses

APPENDIX B

SURVEY ITEMS COMPRISING EACH INDEX

SURVEY ITEMS COMPRISING EACH INDEX

Outcomes

New Teaching Strategies

Q26B1 RET effect: use more hands-on activities in classroom
Q26B2 RET effect: more projects based on real world problems
Q26B3 RET effect: more joint or group projects
Q26B4 RET effect: require more oral/written reports
Q26B5 RET effect: more integrate math/science/technology
Q29_1 Included examples from RET in teaching
Q29_2 Acquired new skills for classroom
Q29_3 Implemented lessons developed at RET

Increased Teaching Capabilities

Q16B3 Awareness: new materials useful to teacher
Q17B4 Understanding: STEM applications in life
Q18A Increased general knowledge base in STEM
Q18C Increased ability to convey STEM excitement
Q18D Increased confidence as STEM teacher
Q18F Increased motivation to improve students' learning

Computers/Technology

Q16B2 Awareness: use computers more effectively
Q18B Increased skills in using the Internet
Q25B2 RET effect: encouraged student access to Internet
Q26B6 RET effect: use computers more
Q26B7 RET effect: use new technologies more

Research Knowledge

Q16B4 Awareness: current STEM research issues
Q17B1 Understanding: how to conduct a research project
Q17B2 Understanding: how to deal with research setbacks
Q17B3 Understanding: how scientific knowledge is built
Q17B5 Understanding: ethical dimensions of STEM research

STEM Career Awareness

Q16B5 Awareness: STEM career options
Q25B1 RET effect: talked w/students about STEM careers

New Materials

Q29_7 Received materials from RET inst
Q29_9 Used contacts to obtain new resources

STEM Publication Awareness

Q16B1 Awareness: magazines/professional journals

Q25B3 RET effect: read scientific journal articles

New Activities/Opportunities

Q18E Increased professional opportunities

Q25B4 RET effect: involved in STEM extra activities

Q29_12 Assumed new leadership roles

Q29_13 I changed jobs

Q29_5 Began teaching new subjects

Networking and Sharing

Q29_10 Organized workshops for other teachers

Q29_11 Networked with other RET teachers

Q29_8 Shared RET-derived info w/teachers

Q31 As result of RET, developed partnership (2004 survey only)

Student Effects: question 27

Q27_2 They are more interested in my classes

Q27_3 They have more positive attitudes about STEM subjects in general

Q27_4 They are less intimidated by STEM subjects

Q27_5 They are doing a better job of learning STEM subjects

Q27_6 They have become more aware of STEM careers options

Q27_7 They have become more interested in STEM careers

Q27_8 They have started/joined a STEM club

Q27_9 They have participated in research at my RET institution

Q27_11 Other RET effects on my students (2004 survey only)

Satisfaction

The RET experience

Q19A Satisfied: relevance to subjects you teach

Q19C Satisfied: helpfulness of grad students

Q19D Satisfied: mentor's knowledge of K-12 teachers

Q19E Satisfied: mentor's help to transfer to classroom

Q19F Satisfied: relationship with your mentor

Q19G Satisfied: op interact w/ faculty

Q19H Satisfied: op interact w/ other teachers

Q19I Satisfied: an integral part of research team

Q19M Satisfied: the RET experience as a whole

Administrative issues

Q19B Satisfied: helpfulness of RET staff

Q19J Satisfied: adequacy of your stipend

Q19K Satisfied: timeliness of your paychecks

Q19L Satisfied: how well organized

Obstacles to transfer to classroom

Q32A The scientific/math topics are too different

Q32B The level of the science/math is too high

Q32C Your school's curriculum is inflexible

Q32D Your school has poor/no access to computers/Internet

Q32E Materials, equipment, etc. are too expensive

Q32F Materials, equipment, etc. that you are planning to use are not yet available

Q32G Not enough time on your part to prepare new lesson/lab plans, etc.

Q32H School administrators are resistant to your proposed changes (2004 survey only)

Q32I Other teachers resent or don't support your proposed changes (2004 survey only)

Q32H Other teachers or administrators at your school are resistant to your proposed changes (2006 survey only)

Q32J Not enough help from the RET team to make the research transferable (2006 survey only)