II. DESCRIPTION OF THE WORKSHOPS

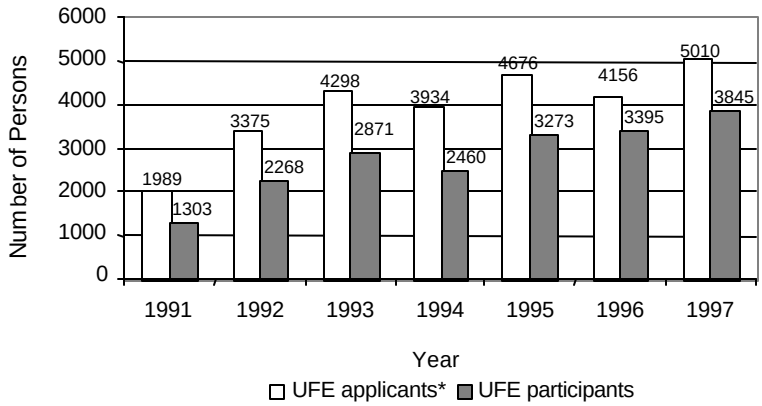
This chapter presents an overall picture of the scope, funding, and disciplinary and thematic coverage of the UFE program. Unless otherwise noted, all exhibits are based on information from the telephone survey of participants.

Awards, Participants, and Funding Levels

From 1991 through 1997, the UFE program awarded almost 500 workshop grants to PIs at colleges and universities, professional societies, and other organizations. Award amounts ranged from less than $10,000 to almost $500,000. The median amount increased from about $65,000 to $90,000.

UFE workshops were quite popular; over the years of the program, the numbers of both applicants and participants increased (see Exhibit II-1). Between 1991 and 1997, almost 27,400 applications were received by UFE Principal Investigators (PIs) from individuals who sought to participate in workshops, and some 71% of those applicants (19,400) were accepted.[1,2] The vast majority of participants -- 16,700, including repeat attendees -- received funding (typically lodging and *per diem)* through the UFE award.

Exhibit II-1. Number of UFE Applicants and Participants, 1991-1997



Note: Exhibit includes duplicated counts of faculty and nonfaculty applicants and participants, as reported by PIs in DUE's annual survey. Numbers include all workshops for each year, including those whose PIs did not respond to DUE's survey. In such cases, the mean numbers of applicants and participants for each year were imputed and included in the totals. For example, in 1991. 54 workshops were held, but PIs reported on 49 workshops comprising 1,182 participants. The mean number of participants reported for the 49 workshops was used to compute the numbers for the other five workshops. Source: DUE database.

Based on lists of participants in 1996 and 1997 workshops, we estimate that 90% of all participants were faculty who teach undergraduates (sometimes referred to in this

[1] Numbers of applicants and participants are not available for workshops held in 1998 and 1999; however, approximately 90 UFE workshops were held in 1998, and fewer were held in 1999.

[2] The data reported in the text and in Exhibit II-2 include duplicated counts of participants within years (those who applied to and/or attended more than one workshop in a given year) and across years (those

report as "undergraduate faculty"). The remaining 10% included secondary school teachers, pre-service teachers, and observers from institutions outside the United States. Exhibit II-2 shows the estimated numbers of faculty who attended in each year from 1991-1997, excluding repeat attendees.[3] Annual PI surveys conducted by the DUE showed that 30% of participants were female, and 16% were members of a minority group (including Asians; see note to exhibit). Twenty-seven percent of the faculty participants were from 2-year institutions, 33% from baccalaureate institutions, and 40% from comprehensive or doctoral institutions. Across those categories, five percent were from Historically Black Colleges and Universities. Data were not collected on representation from other categories of minority-serving institutions.

Exhibit II-2. Unduplicated Number of Undergraduate Faculty at UFE Workshops, Percentages of Female and Minority Participants, and Percentages of Undergraduate Faculty Participants from Various Types of Institutions, by Year

Year	Number of Undergraduate Faculty Participants	Percent Female*	Percent Minority*	Participant's Institutions			
				Percent 2-Year	Percent Baccal.	Percent Comp./Doc.	Percent HBCU***
1991	1,090	21	15	19	38	43	5
1992	1,898	26	15	29	30	41	3
1993	2,403	23	12	24	30	46	4
1994	2,059	31	21	32	29	39	6
1995	2,739	32	18	29	30	41	6
1996	2,842	32	13	23	37	40	4
1997	3,218	36	16	29	38	33	6
Unduplicated total	****14,401**	N/A	N/A	N/A	N/A	N/A	N/A
Percent of total	**100**	**30**	**16**	**27**	**33**	**40**	**5**

*Percent female and percent minority are percentages of all participants as reported by PIs in DUE's yearly surveys. Separate percentages for undergraduate faculty were not available. Percent minority includes all Hispanics and nonwhites. DUE's database did not differentiate between "underrepresented minorities" (which NSF defines as African Americans/Blacks, Hispanics, American Indians, Alaska Natives, and Pacific Islanders) and other minorities.
**Does not equal sum of numbers in column because of duplicate counts of participants across years.
***Historically Black Colleges and Universities. Source: DUE database.

Generalizing from SRI's survey respondents, we estimate that slightly fewer than one-fifth of faculty participants were not on tenure track (many because there was no tenure track at their institution), approximately one-quarter were on tenure track but not tenured, and more than half of participants were tenured. Approximately 22% of participants were assistant professors, 27% associate professors, and 33% full professors.

who applied to and/or attended more than one workshop in various years). See Appendix E for further information regarding calculation.

[3] See Appendix E for calculation.

Exhibit II-3. Academic Rank and Tenure Status of UFE Undergraduate Faculty Participants*

	Percentage of Respondents
Tenure status	
N/A (e.g., no tenure track at institution)	8
Not on tenure track	9
Not tenured	24
Tenured	59
Academic rank	
N/A	7
Instructor/lecturer	11
Assistant professor	22
Associate professor	27
Full professor	33

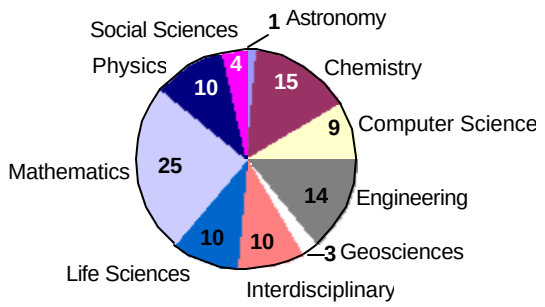
*Based on SRI survey respondents.

Workshop Duration and Coverage

Most UFE workshops were conducted during the summer. They typically were intensive experiences—full-day and sometimes residential. Although workshops ranged in duration from 1 day to 30 days, most were 3 days (15%), 5 or 6 days (35%), or 10 days (14%).

Over the years, UFE supported workshops in all SMET disciplines. The largest single percentage of workshops was in mathematics (25%) and the smallest in astronomy (1%) (see Exhibit II-4). The disciplines of the workshops funded varied slightly from year to year; however, there were no marked trends.

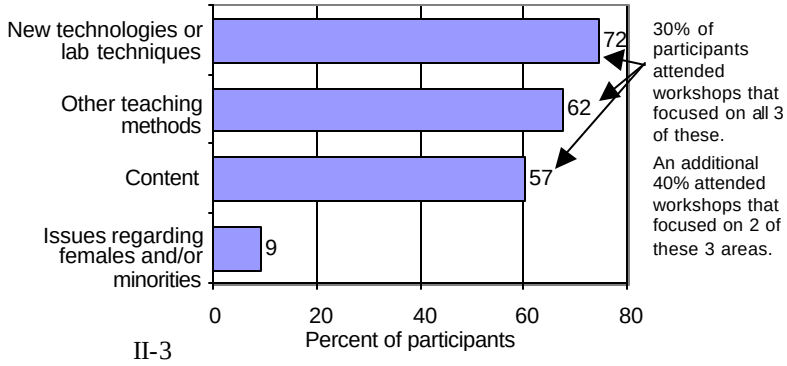
Exhibit II-4. Percentages of UFE Workshops in Various Discipline Groups, 1991-1997



Source: DUE database.

Workshops also varied in their focus on content, teaching methods, and/or lab techniques or technologies. Approximately three-fourths of participants attended

Exhibit II-5. Percentages of Participants Attending Workshops with Various Foci



Source: SRI Participant Survey.

workshops that included a focus on the introduction of new technologies or lab techniques, close to two-thirds of participants attended workshops that included a focus on teaching methods other than technologies or lab techniques, and more than half attended workshops that included a focus on content (more than half such workshops dealt with interdisciplinary content) (see Exhibit II-5).[4] In contrast, about one-tenth of participants attended workshops that dealt with issues regarding females and/or minorities.

Some workshops focused on only one of these areas; however, combining foci was more common. Thirty percent of participants attended workshops that focused on content, teaching methods, *and* lab techniques and/or new technologies, and an additional 40% attended workshops that focused on two of the three areas. All workshops had a real-world focus.

In the "Image Processing Applied to Classroom Teaching" workshop, participants learned to work with remote sensing and image processing technologies. Instructors taught each technology using real-world content in sessions such as "Features of the Seafloor: Evidence of Plate Tectonics" and "Relationships Between Trees: Molecular Taxonomy." Participants then worked on developing their own course units. The purpose of the workshop was to enable participants to incorporate inquiry-based learning using real-world problems into their own courses.

The "Art and Science of Mathematical Modeling" workshop taught applied mathematics content and relevant computer software. In addition, participants learned about what was being modeled—namely, environmental phenomena such as endangered species, forest fires, and water conservation. Sessions on how to incorporate modeling into participants' classrooms focused on both content and teaching methods. The workshop stressed how mathematics could be made relevant for all students.

[4] For most workshops, there was disagreement among SRI survey respondents as to whether the workshop they had attended included each focus shown in the survey, with some participants responding "yes" and others responding "no." Such disagreements are likely to have arisen because of participants' own backgrounds and experiences at the workshops (e.g., a respondent to whom the content presented at the workshop was unfamiliar may have indicated that the workshop focused on new content, but a respondent who was previously familiar with the content may have indicated that the workshop did not focus on new content). Thus, workshop focus is a somewhat subjective area. Therefore, in this paragraph, we present the percentages of *respondents* that reported about each area of workshop focus, not the percentages of *workshops*.

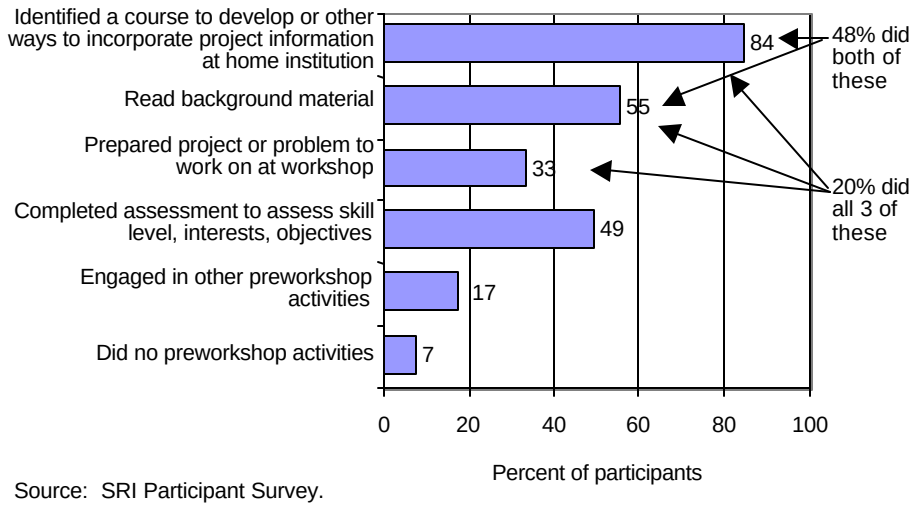
Because of similar cross-participant differences in the rest of the variables in this chapter, all analyses are presented as percentages of participants.

Workshop-Related Activities

Before the Workshops

More than 90% of faculty participants engaged in some type of preparation before attending a workshop (see Exhibit II-6). To increase the probability that participants would actually use what they learned in the workshop to change their own courses, the most common preparation was for participants to identify a course they wanted to develop or some other way in which they would incorporate what they learned at the workshop at their home institutions. Eighty-four percent of participants did this. Fifty-five percent of them read some type of background material, textbooks, or lab manuals; and 33% prepared a project or problem to work on at the workshop. Twenty percent of participants took part in all three types of preworkshop activities.

Exhibit II-6. UFE Participants' Preworkshop Activities



Source: SRI Participant Survey.

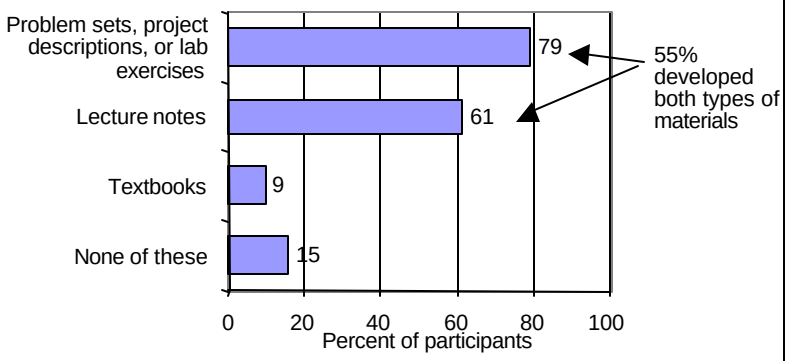
In addition to reading background materials, preparing projects or problem sets, and/or identifying ways to incorporate what they hoped to learn at the workshop, participants often were asked to complete questionnaires to assess their skill level, interests, teaching responsibilities, or objectives to assist PIs in targeting the workshop appropriately. Almost half of participants completed such questionnaires before attending workshops. Close to one-fifth of participants engaged in some other type of preworkshop activity, such as preparing a presentation or proposal, holding meetings or discussions, etc.

During the Workshops

Participants took part in a variety of activities at the workshops. Although many workshops included a lecture component, all workshops included hands-on activities (which were a criterion for being funded), and almost all included development of some types of materials.

Development of materials. The most common type of materials developed at workshops were problem sets, project descriptions, or lab exercises, with 79% of participants working on such materials (see Exhibit II-7). This focus is hardly surprising, given most workshops' goal of helping participants move to more inquiry-based teaching. Also common was development of lecture notes or other handouts, with 61% of respondents developing these. More than half of participants (55%) worked on both types of materials. Working on textbooks was much less common; 9% of participants did so. Again, this finding is not surprising, given the problem- and project-based orientation of the workshops.

Exhibit II-7. Types of Materials Developed by Participants at UFE Workshops



Source: SRI Participant Survey

Despite the fact that most workshops lasted only 10 days or less, a substantial percentage of participants (approximately 40%) left workshops with at least one type of material completed and ready for use in their courses.

The "Geometry of Multivariable Calculus" workshop provided participants with ways to help their students gain mathematical intuition through visualizing concepts. It had a strong real-world component, with several guest speakers from industry. Through previous experience, the workshop's PI knew that many math professors don't teach real-world applications because they lack the time to develop new modules for their courses. Consequently, approximately half of the time of this 1-week workshop was devoted to work on modules. At the end of the workshop, most participants had completed one module. Many modules were shared, not only within participant groups but also across groups.

At the Image Processing workshop, participants began work on instructional modules that encompassed data and images produced by remote sensing and image processing technologies. Although some participants completed their units, most—particularly those with little background before the workshop—had more work to do after the workshop to complete the units.

Presentations. Approximately three-quarters of workshops included presentations by participants so that they could experience how their new projects or teaching techniques would actually play out in the classroom. Typically, presentations were a relatively minor part of the activities, with some participants giving no presentations at all. However, in a few workshops, presentations were a major activity, as evidenced by the fact that 5% of participants gave at least three presentations at the workshops they attended.

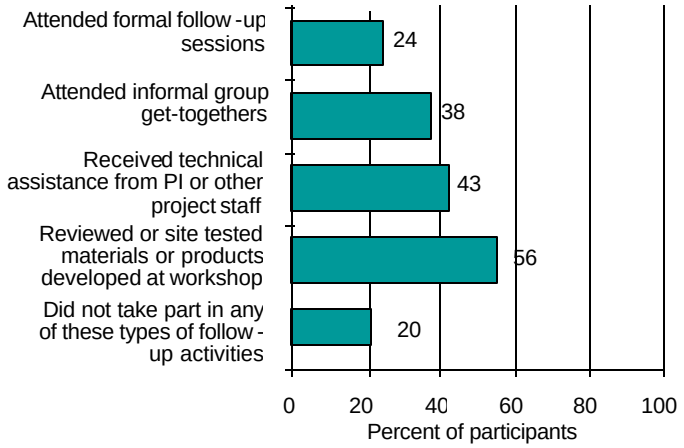
"Teaching Teachers to Teach Engineering" was a workshop dedicated exclusively to the improvement of teaching methods in large lecture-class situations. Instructors conducted model whole-class sessions in which they demonstrated best practices in organization, black- or white-board techniques, questioning of students, and continual monitoring of student engagement. A great deal of the workshop was dedicated to participants' conducting practice classroom sessions and receiving feedback from a small group consisting of an instructor, a mentor, and four participants. Over the course of the workshop, all participants delivered at least three practice sessions to their team. In addition, each participant observed and participated in critical discussions of at least 12 practice sessions of his or her team members.

After the Workshop

The UFE PIs appear to have been excellent at following up with participants; the great majority of participants at UFE workshops (80%) took part in some type of follow-up activity, as shown in Exhibit II-8.

Follow-up sessions. Many workshops were designed to include formal follow-up sessions to provide participants an opportunity to discuss how they had implemented what they had learned, report their successes and challenges, work further on their materials, and, in some cases, learn more advanced content or techniques. However, relatively few of the original participants (about one-fourth) attended formal follow-ups. According to PIs, nonattendance often was due to competing demands on participants' time.

Exhibit II-8. UFE Participants' Follow-up Activities



Source: SRI Participant Survey.

Informal follow-up get-togethers were somewhat more common, with 38% of participants attending them. Like formal follow-up sessions, such reunions (which often took place at professional meetings) also offered participants opportunities to share their postworkshop experiences. Altogether, 46% of participants attended formal and/or informal follow-up activities.

Technical assistance. Even when workshops did not feature follow-up sessions, the workshop PI or staff still were fairly likely to provide technical assistance after the workshop. Forty-three percent of all participants (including approximately one-third of those who did not attend either formal or informal follow-up activities) received technical assistance from the workshop PI or staff after the workshop.

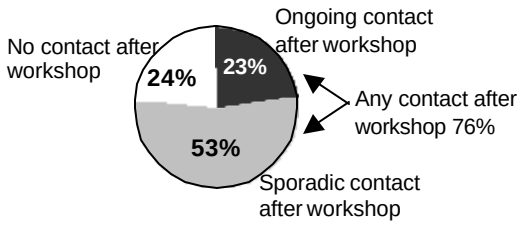
Site testing and review of materials. The most common type of postworkshop activity, engaged in by more than half the participants, was site testing or review of materials that they or others had developed at or after the workshop. This type of activity kept participants actively engaged in the substance and focus of the workshop.

A 1-day follow-up session was held a year after the workshop "A Cognitive Based Approach to Curriculum Development as Applied to Introductory Courses." The purpose of the session, attended by 7 of the original 21 participants, was to share successes and challenges. Topics included how to apply what was learned in the workshop in a variety of courses, how to measure student performance, and how to overcome institutional resistance.

"Workshop Biology" disseminated a biology course for nonmajors that had been developed with grants from NSF's Course and Curriculum Development (CCD) program and the Department of Education's Fund for the Improvement of Postsecondary Education (FIPSE). The project maintained a Web site on which participants posted their course descriptions and materials. In the third year of its UFE award, the project hosted a 3-day follow-up session for selected participants and facilitators from the previous years' workshops. Each was asked to provide a reflective statement about his or her own experiences in implementing Workshop Biology. These papers then were used as the starting point for a series of discussions and brainstorming sessions about student learning, organizational change, and strategies for the future.

Postworkshop communication. Typically, site testing and/or reviewing materials also involved electronic exchanges of information. In fact, approximately three-quarters of participants had electronic communication with workshop PIs and/or other participants following the workshops. This communication tended to be sporadic, rather than ongoing, as would be suggested by a cycle of site testing and communication. However, it is noteworthy that almost one-quarter of participants engaged in *ongoing* communication with PIs or participants after the workshop.

Exhibit II-9. Percentage of Participants in Contact with UFE PIs or Participants after the Workshop



Source: SRI Participant Survey.

Summary

The number of UFE awards and workshops grew sharply from the first fiscal year examined (1991) until they stabilized in fiscal years 1993 through 1997. During that period, the number of faculty applications continued to increase steadily, from about 2,000 to 5,000 annually. Altogether, some 27,400 persons applied, about 90% of whom were undergraduate faculty. Approximately 71% of applicants participated in workshops.

PIs were very creative in designing the required hands-on component of the workshops. All workshops focused on "real-world" phenomena—some in the context of new content, others in the context of laboratory methods and/or new technology. Although very few workshops focused on teaching methods alone, most included teaching methods along with their primary focus.

The vast majority of participants worked on some type of materials for their own courses, and a substantial percentage of participants completed work on their materials at the workshop. After the workshop, more than half of participants reviewed or site tested materials or products developed by themselves or others at the workshop, often receiving technical assistance from the project PI or workshop staff. Close to half also attended formal or informal follow-up activities.

The importance of the various foci of workshops, the types of materials worked on, and follow-up activities to participants' subsequent behaviors will be discussed in Chapter VI.