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SURVEY 2001: THE STATUS OF ATE PROJECTS AND CENTERS

INTRODUCTION

The 2001 survey is the second annual survey of the National Science Foundation (NSF) Advanced Technological Education (ATE) program[1]. Eighty-one (81) *projects*[2] (70 projects and 11 centers) were asked to participate in this survey[3]. The purpose of the annual survey is to describe the *projects*' efforts and impacts and thereby describe the ATE program. When combined with other information and criteria, these annual descriptive findings and indices provide a basis for judging the overall impact and effectiveness of the ATE program. Findings from the survey are expected to be useful to NSF staff in preparing their annual GPRA[4] reports and making programmatic decisions. ATE *projects* are likely to use survey results to learn about the activities and findings of other *projects* and to serve their own improvement needs.

A brief description of the minor changes to survey items and improvements in the survey's structure made from 2000 to 2001 are available in Appendix A, page 58. Also provided in this same appendix are descriptions of the sample, the web-based survey practices employed (contacts, follow-up procedures), response rate information, and data analysis steps and cross-checks to ensure accuracy of findings. A copy of the survey is also attached (Appendix B, p. 61)

At the time the survey sample was selected in October 2000, 123 *projects* were under way (i.e., currently in their grant-funding period). The 81 included in the survey sample were all *projects* that had been active for at least a one-year period. Ninety three percent of that sample, 75 *projects* (11 centers and 64 projects), completed and submitted survey responses within the prescribed time frame (February 20-April 9,

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[1]See the *Status Report 1* for descriptive information about the ATE program and the *Status Report 2* (http://www.ate.wmich.edu) for a report of the 2000 survey findings.

[2]The term "project" has double meaning for the ATE program. It is uniformly used by NSF to refer to all entities that receive funding, and it also it refers just to smaller grant efforts. The ATE program labels its largest and most complex projects as centers. To provide clarity in referencing these groups, the term projects (unitalicized) will refer to the smaller grants, centers will refer to the subgroup of larger grants, and *projects* (in italics) will be used to refer to the full group of projects and centers.

[3]Ninety-six percent of the current sample (78 of 81 *projects*) was also in the 2000 survey sample. Conversely, approximately 70 percent of the *projects* sampled in 2000 were also in the 2001 sample. The 2000 survey sample contained all 113 *projects* that were active at the time of the survey. The 2001 survey was limited to *projects* that had been active for at least one year. Therefore, as the percentages show, the 2001 sample is nearly a subset of the 2000 sample.

[4]Government Performance Results Act. For current information about NSF's response to this requirement see its web page at http://www.nsf.gov/od/gpra/

2001). The results and findings reported here are based on those 75 responses. A comparison of the findings from both years of the survey is also provided.

In both years, the survey form contained nine sections. All *projects* were asked to complete three sections–one that requested confirmation of general *project* information collected from other sources (e.g., name of Principal Investigator and the nature and duration of grant), one that addressed the NSF program staff's efforts to monitor the *projects*, and one addressing several overarching and general *project* issues. Additionally, each *project* was asked to complete one or more additional sections focusing on the four primary categories of work that the ATE program supports: collaborations, materials development, professional development, and program improvement (see the category descriptions in the box below). Those that responded to

- **Collaborations** of *projects* with businesses, industries, educational institutions, and other organizations to achieve *project* objectives. Collaborations serve the other three work categories (materials development, program improvement, and professional development) to achieve ATE program objectives.
- **Materials development** conducted by *projects*. "Materials" include one or more courses, modules, process models, and/or other instructional or assessment units. "Development" includes the preparation, adaptation for implementation, and/or testing of materials.
- **Program improvement efforts** at the (a) secondary school, (b) associate degree, and (c) baccalaureate degree levels. "Program improvement" refers to multiple, related courses, and/or field experiences for students at the designated education level that lead to a defined outcome such as a degree, certification, or occupational completion point.
- **Professional development efforts** focusing on instruction and/or support provided to teaching faculty and staff to update their knowledge and skills and to train them to teach new or improved curricula effectively.

the program improvement category were asked to complete the section for each educational level (secondary school, associate degree, and baccalaureate) where improvement efforts were targeted. A large and diverse project or center (i.e., one that engages in all identified types and levels of effort) would be expected to complete all nine sections. The smallest and narrowest of projects would complete just four sections (Two responding projects were anomalies in that they completed only the three overarching sections).

SURVEY FINDINGS

In this report, we present findings from the four primary work categories–collaborations, materials development, program improvement, and professional development–with a brief section on the findings from the PI overview on the *projects*[5] and a comparison of findings from both years of the survey. The overview information (nature and scope of activity and general program patterns) is presented first to provide context for the more narrowly focused work sections. Collaboration efforts are described second because *projects* so uniformly used collaborations for their work in all identified categories.

Overview–Nature and Scope of Activity

The ATE program expects its *projects* to collaborate, develop materials, improve their programs of instruction, and provide professional development to disseminate the model materials and programs developed. Neither Congress nor NSF has specified what number or proportion of the ATE *projects* should be engaged in each of the identified work categories. Neither have they stated the exact nature of work necessary to improve the workforce capabilities of technicians in our nation. Without such specifications, we chose not to render judgments about the adequacy of these *projects* in such matters as sufficient collaboration, adequate resources for professional development, and so forth. Instead, the primary findings for each work category are largely descriptive and serve as a baseline and trends data for tracking the ATE program's progress.

Five general indicators were used to determine the nature and extent of project activities: (1) number of work categories in which *projects* engage, (2) project stability, (3) unintended outcomes, (4) barriers and challenges to project productivity, and (5) evaluation efforts. These indicators are based on ATE objectives as found in the *ATE Guidelines for Proposal Development*. Responses indicate the extent to which the program objectives are being addressed by the *projects*. Findings from these indicators uniformly suggest that *projects* actively address the goals of the ATE program and engage in evaluation to direct their efforts and assess their progress.

- Nearly all *projects* (97%) reported on work in at least one of the categories prescribed in the ATE program guidelines. Two responding projects were anomalies in that they completed only the three required sections.
- The large majority of *projects* are stable or increasing in measures of work and productivity.
- The majority of unintended outcomes that were reported are positive, with spin-off benefits from collaborative efforts mentioned most frequently.

[5]The findings for the monitoring section are provided to NSF in a separate report.

- Listed barriers are indicative of efforts to stretch programs, resources, and relationships to accomplish desired goals.
- *Projects* do engage evaluators and conduct needs assessments.

Work Categories

Table 1 provides a breakdown of the nature of work conducted by the 75 *projects*. Presuming the responses are representative of the ATE program, 76 percent of the *projects* engage in collaboration, 83 percent engage in materials development, 67 percent engage in program improvement, and 77 percent engage in professional development.

Table 1 also shows that collaborative relations with other organizations, including education, public agencies, foundations, and especially business and industries, are integral to conducting materials development, program improvement, and professional development work. Centers are expected to develop collaborative arrangements as means to those ends, and projects are also encouraged to develop such collaborations. The survey responses suggest that all centers and approximately 72 percent of projects (76 percent for *projects*) reported engaging in collaborative activities.

There are two caveats for the reported work categories. First, it appears that more *projects* had collaborative relationships than were reported. When conducting 13 site visits in late 2000 and early 2001, we observed collaborative relationships at all 13 visited sites. However, only 8 of the 10 *projects* (80%) from this set of 13 responding to the 2001 survey indicated they were engaged in collaborations. This discrepancy between observed and survey findings is most likely due to the survey question language (i.e., request for information on more “formal” collaborations [e.g., collaborations resulting in monetary or time contributions to the *projects*]). Second, materials development efforts were not separated on the survey by purpose (e.g., commercial distribution or program improvement). However, based on the number of *projects* that filled out this section but did not complete the program improvement section, we estimate that approximately 20 percent of the *projects* focus on materials development for commercial dissemination.

Table 1. Number of *Projects* Engaged in Various Combinations of Work Categories		
Work Category Combinations*	**Number of Respondents in Each Combination**	**Number of Respondents in Combination Category**
C, MD, PI, PD (all 4)	32	32
C, MD, PI (3 of 4)	4	20
C, MD, PD (3 of 4)	8	
C, PI, PD (3 of 4)	2	
MD, PI, PD (3 of 4)	6	
C, MD (2 of 4)	4	19
C, PI (2 of 4)	1	
C, PD (2 of 4)	5	
MD, PI (2 of 4)	4	
MD, PD (2 of 4)	3	
PI, PD (2 of 4)	2	
C (1 of 4)	1	2
MD (1 of 4)	1	
PI (1 of 4)	0	
PD (1 of 4)	0	
None of 4	2	2
Total	75	75

Notes:
*C=Collaborations, MD=Materials Development, PI=Program Improvement (at least one of the three levels [secondary, associate, baccalaureate] under this category), PD=Professional Development

More importantly, as Table 1 shows, most *projects* engage in several categories of work effort. Indeed, more than 40 percent address all 4 work categories, 70 percent address at least 3 of the 4 work categories, and 94 percent address at least 2. Because a *project* could conduct program improvement efforts for one or more educational levels, Figure 1 characterizes the nature and extent of *projects'* efforts across these levels. As that figure shows, slightly more than a quarter engaged in at least two levels (e.g., secondary and associate levels). Such cross-level development efforts indicate attention to developing cross-institution-compatible programs and/or program partnerships.

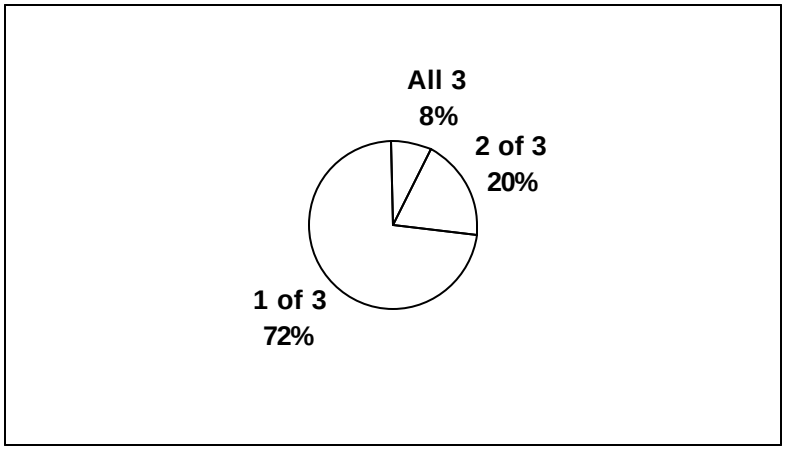

Figure 1. Percent of Respondents Addressing Program Improvement Level Combinations (Secondary, Associate, Baccalaureate)

***Project* Stability**

Project stability was addressed through 13 items, 10 of which required open-ended answers for all or part of the questions embedded in the item.

The first item asked respondents to rate the *project's* current status against its status the previous year on a set of 10 factors[6]. Results for item 1 are shown in Tables 2 and 3. These results suggest that *projects* generally are thriving. For *projects*, the trend is at least stable for all 10 factors. Projects have medians of at least four (some increase) on six of the factors, and centers have medians of at least four on five of the factors. Though not labeled as such in the survey, nine of the individual factors were chosen as indicators for the four program categories, and the two tables are organized to show responses in conjunction with those categorizations. For each category, responses indicate general stability or increases in *project* productivity. It is especially noteworthy that in the important matters of direct participation with other institutions and organizations, use of developed products, student enrollment, and student placement, the large majority of *projects* indicate either some increase or a substantial increase.

[6]Since not all *projects* engage in the same types of activities, not all status factors were pertinent to all *projects*.

Table 2. Project Ratings of Current Status Versus Status a Year Ago (N = 64)

Factor	Substantial Decline (%)	Some Decline (%)	Stable (%)	Some Increase (%)	Substantial Increase (%)
Size of staff (n=59)	5	10	69	14	2
Collaborations					
Financial support from other organizations (n=53)	0	7	61	23	9
Direct participation by other institutions and organizations (n=57)	0	3	41	44	12
Materials Development					
Income from center/project-developed products (n=14)	7	7	50	29	7
Use of center/project-developed products (n=45)	0	0	31	47	22
Program Improvement					
Students enrolled (n=45)	0	11	31	27	31
Students placed in related technical jobs, whether they completed program or not (n=33)	0	3	37	33	27
Students graduating or completing the program (n=35)	0	12	37	31	20
Professional Development					
Number of professional development opportunities (n=55)	0	9	42	31	18
Amount of participation in professional development opportunities (n=54)	0	4	44	32	20

Notes: Substantial Decline (>20%), Some Decline (5-20%), Some Increase (5-20%), Substantial Increase (>20%)
* Individual item ns = 64 - no. of Not Applicable Responses

Table 3. Center Ratings of Current Status Versus Status a Year Ago (N = 11)					
Factor	**Substantial Decline (%)**	**Some Decline (%)**	**Stable (%)**	**Some Increase (%)**	**Substantial Increase (%)**
Size of staff (n=10)	20	20	40	20	0
Collaborations					
Financial support from other organizations (n=11)	0	9	55	18	18
Direct participation by other institutions and organizations (n=11)	0	9	27	55	9
Materials Development					
Income from center/project-developed products (n=8)	0	0	37	38	25
Use of center/project-developed products (n=11)	0	0	9	55	36
Program Improvement					
Students enrolled (n=9)	0	0	45	33	22
Students placed in related technical jobs, whether they completed program or not (n=6)	0	0	17	50	33
Students graduating or completing the program (n=9)	0	11	45	33	11
Professional Development					
No. of professional development opportunities (n=11)	0	37	27	27	9
Amount of participation in professional development opportunities (n=11)	9	0	36	37	18

Notes: Substantial Decline (>20%), Some Decline (5-20%), Some Increase (5-20%), Substantial Increase (>20%)
* Individual item ns = 11 - no. of Not Applicable Responses

Unintended Outcomes

When respondents were asked to describe significant unintended outcomes (positive and/or negative) of their *projects'* work, most reported were positive in nature. The unintended outcomes most cited by respondents were successful use of partnerships and networking (17) and applications to or work with other disciplines (14). Table 4 provides a summary of some of the most common responses.

Table 4. Unintended Outcomes Categories and Examples

Categories	Examples
Partnerships, Networks, Collaborations	Networking, outreach to other states, outreach to other countries, in-kind gifts. A national network of actively participating instructors who discuss best practices. The scope and depth of the partnerships that have come about as a result of the center have been significant. Linking science and technology faculty, excellent support and commitment of all partners. In presenting our work at various regional and national meetings, we have met teachers who are very interested in our work and have given us helpful advice on ways we can improve the materials we have developed. Increased collaboration between educational institutions. Although we hoped for collaboration among the workshop participants and workshop leaders, we did not expect this to occur.
Applications to Other Disciplines/Work with Other Disciplines	Foundation for better * program and networking/partnerships. Greatly increased interest in * and enhanced curriculum development of high school * science programs with * being recognized in a leadership role. The project has led us into the area of science and mathematics training of pre-high school teachers, and the potential role of * in delivering and enhancing that training. This has motivated the chemistry department to maintain a cutting edge in its student laboratory work. * has achieved a national leadership position in providing solutions for IT education and is frequently invited to national and international forums on the topic of the IT workforce shortage. The project was able to transport best practices beyond the * area more quickly than anticipated. Many organizations, individuals and even the State of * is viewing our model as perhaps a model for the next generation learning system which is based upon competencies and precision learning through the most appropriate use of technology - in support of the uniqueness of the individual and or the organization.

Table 4. Unintended Outcomes Categories and Examples	
Categories	**Examples**
Applications to Other Disciplines/Work with Other Disciplines continued	ATE has become an attitude and "buzz word" for better teaching and a student-learning approach to technician education in *. W have companies interested in creation of similar type educational programs for other segments of the industry.
Additional Funding Received	Current project is fostering increased participation and interest by local industry–they are providing significant matching funds. Additional funding from public and private sectors.
Notes: Asterisks (*) were substituted for specific *project* or program names.	

Barriers and Challenges

Respondents also identified barriers or challenges to the success that occurred in their *projects*. The most common included lack of time, money, and other resources (16); lack of administrative support (11); attracting/keeping faculty and other critical staff members (12); communication and coordination (10); and faculty having difficulty adapting to the changes needed for the new programs (7). The comments listed in Table 5 are provided to illustrate these barriers/challenges. Not surprisingly, the listed barriers identify many situations and conditions that are familiar to all programs that seek to change the status quo.

Table 5. Illustrative Barriers/Challenges Faced by the *Projects*	
Categories	**Examples**
Lack of Time, Money, and Other Resources	Time lines, curriculum development obstacles, materials production. Rapid changes in the field, which complicate the curriculum and curriculum change process. Difficulties in space allocation with large enrollment growth. Too few full-time people. Staff changes, overworked staff, scheduling, getting business/industry at events.
Lack of Administrative Support	2-year administrative support is extremely lacking in sponsored projects arena. Gaining cooperation from high school administrations relative to the installation of recirculating * systems. Lack of support from administration, not enough space on campus, internal issues between staff, lack of department support. Administrative changes sometimes proceed at what seems to be a glacial pace.

Table 5. Illustrative Barriers/Challenges Faced by the *Projects*	
Categories	**Examples**
Attracting and Keeping Faculty and Other Critical Staff Members	Lead teacher cohort stability (faculty attrition). PI/Co-PI changes. The major challenge has been finding qualified people to develop the new curriculum. Availability of qualified community college faculty and constant threat of loss of qualified faculty to industry.
Communication and Coordination	Finding a way to persuade colleagues that the learning in their classrooms would be improved through communication/collaboration with other * faculty. Creating working partnerships between community colleges and community organizations, given their differing cultures and missions. One challenge would be the number of partners in the project. This project is a statewide project and involves all twelve community colleges in * and two of the state universities. Coordination of materials development projects. The difference from state to state relative to the course syllabi (especially where schools mandate the passing of high stakes tests).
Faculty Issues with Adapting to Change	Reluctance of high school teachers to adopt materials because they are already over-worked. Dealing with teachers whose main goal is presenting content rather than helping students to learn. The greatest challenge we face is getting faculty to accept and try new ways of teaching. Working with people whose jobs are threatened as a result of our project.

Evaluation Efforts

Three additional questions were asked regarding *project* evaluations, all pertaining to whether the *project* used an evaluator. None addressed any matters of extent or quality of the evaluations being conducted. Of the 75 respondents, 88 percent indicated they have an evaluator. Of those having an evaluator, most (77 percent) employ an evaluator external to the *project*, but 18 percent indicated use of both external and internal evaluators.

Because needs assessments are viewed as an essential evaluative tool to guide *project* work, respondents were asked to identify if and when in the *project* life they conducted a needs assessment. Of the 75 respondents, 81 percent reported having completed a needs assessment to serve *project* needs. Seventy-seven percent reported conducting a workforce needs assessment prior to submitting their *project* proposal to NSF, and 47 percent indicated they conducted a needs assessment after they received funding.

Collaborations

A basic premise of Congress and NSF is that in order to better prepare the workforce to meet business and industry needs for technicians, the associate degree level institutions must develop and implement strong collaborative working relationships with a variety of institutions, all of whom are interested in expanding the skill and knowledge of technicians. NSF, in turn, has made development of collaborations among these groups an expected outcome of the ATE *projects*.

Nature and Extent of Collaborations

ATE *projects* have established a large number of collaborative arrangements. The collaborations serve multiple purposes and provide monetary support as well as other kinds of assistance for materials development, program improvement, and professional development efforts.

Several of the questions posed to *projects* on the survey addressed collaborations, and these are paraphrased below (Items 1-5 of Project & Center Work–Collaboration).

- The amount of money and the monetary value of in-kind support provided by institutions and organizations to serve the *project's* objectives
- The number and types of institutions, and the numbers of persons in those institutions, with which the *project* had developed collaborative relationships
- The types of purposes served by the collaborations, and which types of institutions served which purposes
- *Project* ratings of the level of quality/productivity of the collaborative relationships.
- Which institutional relationships were most effective and the most important products and/or results of those collaborations

Projects have established a large number of collaborations with business and industry, education, federal and state agencies, and other organizations. Approximately 98 percent of *projects* responding to this section reported work to develop collaborative arrangements with other institutions. The median *project* lists 22 or more collaborative efforts (projects=18, centers=68) and engages slightly more than two people per collaboration (projects=2, centers=3). Sixty-four percent reported collaborative work with four or more different types of institutions/organizations.

As Table 6 shows, the most prevalent type of collaboration for projects is with business and industry organizations (83%). Median number of collaborations for this category is six, and the median total number of persons collaborating is ten. All centers collaborated with three types of groups–business and industry, associate degree level education institutions, and baccalaureate degree colleges or universities. Consistently, centers report a higher median number of collaborations than projects with each collaborating institution type. The highest median number of collaborations (20) was reported for centers with associate degree institutions.

Table 6. Nature and Extent of Collaborations					
Types of Collaborating Institutions	**Projects or Centers Reporting Collaborations (of n)**	**Percent (%)**	**Number of Collaborations per Institution (Median)**	**Range (Low-High)**	**No. of Persons Collaborating per Institution Type (Median)**
Projects (n=46)					
Business and Industry	38	83%	6	2-50	10
Public Agencies	20	43%	3	1-19	6
Organizations and Professional Societies	23	50%	2	1-5	3
Secondary Education (e.g., high schools)	23	50%	8	1-50	14
Associate Degree Level Education Institutions	29	63%	6	1-28	8
Baccalaureate Degree Colleges or Universities	31	67%	2	1-36	4
Other	5	11%	2	2-26	20
Centers (n=11)					
Business and Industry	11	100%	15	2-50	30
Public Agencies	8	73%	5	1-25	9
Organizations and Professional Societies	9	82%	5	1-6	6
Secondary Education (e.g., high schools)	9	82%	14	3-62	29
Associate Degree Level Education Institutions	11	100%	20	5-70	68
Baccalaureate Degree Colleges or Universities	11	100%	7	2-20	11
Other	2	18%	2	1-3	9

Projects report having received more than $12,000,000 in direct contributions of money and nearly $24,000,000 of in-kind support from non-NSF sources (Table 7) (Centers tend to receive more contributed money than do projects). That is, for every dollar provided by NSF for the duration of the *projects'* grant periods, the *projects* reported increasing their working resources for the ATE program by 80 cents. Viewed from a cost-sharing basis (total of all non-NSF dollars received divided by NSF grant dollars for reporting *projects*), contributions to date amount to 19 percent for projects and 38 percent for centers. For in-kind support, the cost-sharing percentage for reporting *projects* is 65 percent for projects and 36 percent for centers.

Table 7. Total Received to Date by *Projects* by Type of Institution n=57: 46 projects (P), 11 centers (C)		
Type of Supporting Institution	**Total Monetary Support Received to Date ($)**	**Estimated Monetary Value of In-Kind Support ($)**
Lead Institution	1,331,516 (P) 4,081,273 (C)	5,533,860 (P) 1,262,000 (C)
Foundations	391,511 (P) 200,000 (C)	348,400 (P) 0 (C)
Business & Industry	854,900 (P) 601,000 (C)	10,202,741 (P) 4,687,000 (C)
Local & State Public Agencies	1,052,252 (P) 272,000 (C)	101,252 (P) 68,000 (C)
Non-NSF Federal Sources	635,753 (P) 667,000 (C)	59,248 (P) 370,000 (C)
Organizations and Professional Societies	335,700 (P) 5,000 (C)	116,500 (P) 182,000 (C)
Secondary Education	349,613 (P) 108,145 (C)	155,200 (P) 21,000 (C)
Associate Degree Level Institutions	31,500 (P) 230,672 (C)	515,500 (P) 193,000 (C)
Baccalaureate Degree Colleges or Universities	23,000 (P) 23,000 (C)	138,700 (P) 45,000 (C)
Income from Products and Services	38,135 (P) 962,617 (C)	0 (P) 0 (C)
Other	5,000 (P) 5,000 (C)	17,600 (P) 0 (C)
Total from All Non-NSF Sources (A)	5,048,880 (P) 7,155,707 (C)	17,189,001 (P) 6,828,000 (C)
Total NSF $ for Reporting Projects and Centers (B)	26,490,875 (P) 18,896,292 (C)	26,490,875 (P) 18,896,292 (C)
Cost Sharing Percentage ((A/B) x 100)	19% (P) 38% (C)	65% (P) 36% (C)

We asked *projects* to report the number of collaborations they initiated to serve *project* objectives. A summary by these objectives is presented in Table 8. The survey identified a collaboration as a relationship between a *project* and another institution or

organization to serve a particular purpose and provided 15 separate purpose options for response by a *project*. Responses to these questions yielded a total of 13,000 collaborations. A more conservative way to view collaboration is as a relationship with an institution or organization regardless of how many purposes or objectives are served by that relationship. Viewed in that way, many of the 13,000 collaborations were reported by the *projects* in more than one category. The exact number cannot be determined from available data. The maximum number of times that a collaboration could be counted is 15 (i.e., total number of purposes listed in Table 9). If that unlikely event always occurred, the total number of unique collaborations would still be larger than 900–nearly 16 collaborations per *project*. Approximately a quarter of the collaborations are general in nature, providing advice, general assistance, and equipment. The large majority are intended to serve materials development, program improvement, and professional development purposes.

Table 8. Number of Collaborations by Different Types of Organizations and Specified Purposes
n=57: 46 projects (P), 11 centers (C)

General Category	Business or Industry	Public Agencies	Educational Institutions	Other Organizations	Total
General Support	850(P) 386(C)	180(P) 124(C)	783(P) 568(C)	90(P) 92(C)	1,903(P) 1,170(C)
Materials Development	558(P) 631(C)	73(P) 103(C)	757(P) 594(C)	91(P) 83(C)	1,479(P) 1,411(C)
Program Improvement	958(P) 594(C)	121(P) 171(C)	663(P) 1,201(C)	72(P) 56(C)	1,814(P) 2,022(C)
Professional Development	727(P) 275(C)	210(P) 99(C)	811(P) 1,302(C)	74(P) 33(C)	1,822(P) 1,709(C)
Total for *Projects*	4,979	1,081	6,679	591	13,330

Table 9 breaks down the collaborations by activity to more clearly show the nature of collaborative purposes and activities. Only those respondents that reported at least one collaborator of a type (e.g., general advice) were included in the percentages reported. For example, in cell one of the table, 83 percent of the 46 projects reported at least one collaborator providing general advice.

Table 9. Percent of *Projects* that Collaborate with the Different Types of Organizations to Serve Specified Purposes
n = 57: 46 projects (P), 11 centers (C)

Purpose	Business or Industry	Educ. Institutions	Public Agencies	Other Organiza-tions
General Support				
Advice (e.g., advisory panel)	83% (P) 100% (C)	80% (P) 91% (C)	52% (P) 64% (C)	39% (P) 64% (C)
Contributed time and effort (beyond advice)	72% (P) 100% (C)	74% (P) 91% (C)	41% (P) 64% (C)	37% (P) 45% (C)
Contributed or shared equipment/technology	61% (P) 54% (C)	43% (P) 45% (C)	24% (P) 27% (C)	13% (P) 27% (C)
Materials Development				
Determining or confirming materials content	56% (P) 64% (C)	61% (P) 91% (C)	33% (P) 27% (C)	15% (P) 18% (C)
Development or implementation of standards/guidelines	52% (P) 54% (C)	54% (P) 64% (C)	24% (P) 45% (C)	13% (P) 36% (C)
Pilot testing of materials (preliminary testing of materials or portions of materials; usually done with a small number of sites)	20% (P) 36% (C)	50% (P) 91% (C)	11% (P) 36% (C)	6% (P) 18% (C)
Field-testing of materials (testing of materials in settings where they will be used; usually larger and more in-depth than pilot testing)	13% (P) 27% (C)	41% (P) 82% (C)	11% (P) 18% (C)	2% (P) 9% (C)
Professional Development				
Faculty/staff knowledge of industry needs, opportunities, and requirements	61% (P) 64% (C)	59% (P) 100% (C)	33% (P) 27% (C)	24% (P) 27% (C)
Faculty/staff knowledge and skill in the discipline	46% (P) 54% (C)	61% (P) 91% (C)	28% (P) 27% (C)	26% (P) 27% (C)
Business and industry representatives' knowledge of educational options and opportunities	54% (P) 73% (C)	26% (P) 45% (C)	28% (P) 27% (C)	11% (P) 27% (C)

Table 9. Percent of *Projects* that Collaborate with the Different Types of Organizations to Serve Specified Purposes
n = 57: 46 projects (P), 11 centers (C)

Purpose	Business or Industry	Educ. Institutions	Public Agencies	Other Organizations
Program Improvement				
Student understanding of industry opportunities and requirements	52% (P) 82% (C)	37% (P) 64% (C)	20% (P) 36% (C)	15% (P) 45% (C)
Work-based instruction and experience matters (e.g., internships, practica, etc.)	48% (P) 73% (C)	24% (P) 36% (C)	17% (P) 36% (C)	11% (P) 18% (C)
Student recruitment program	43% (P) 64% (C)	43% (P) 91% (C)	22% (P) 36% (C)	13% (P) 45% (C)
College/school-based instruction matters (e.g., course instruction, field-testing of materials, etc.)	30% (P) 27% (C)	52% (P) 82% (C)	17% (P) 9% (C)	13% (P) 27% (C)
Student entry to the workforce	46% (P) 64% (C)	17% (P) 54% (C)	20% (P) 36% (C)	15% (P) 36% (C)

- ***General Support***. There are two general patterns for general support as illustrated in Table 9. First, most collaborations provide general advice, followed by additional support and assistance and sharing of equipment/technology. Similarly, most collaborations occur with business and industry, with decreasing proportions from educational institutions, public agencies, and other organizations. Thus, the large majority (83% for projects, 100% for centers) use collaborations with business and industry for general advice purposes.

- ***Materials Development***. The majority of centers and the majority or near majority of projects work with other educational institutions in all aspects of materials development work from determination of content through testing of developed products. Most *projects* work with business and industry in the early stages of materials development (e.g., determination of content and specifying standards), but a smaller proportion are engaged in the pilot and field-testing efforts. The same pattern occurs for public agency and other organization collaborations.

- ***Professional Development***. Collaborations with business and industry most frequently serve development of faculty knowledge of industry needs and opportunities and, correspondingly, business and industry knowledge regarding educational options and opportunities. A smaller but substantial proportion (46% for projects, and 54% for centers) engage business and industry for development of faculty skills in the discipline area.

  As would be expected, the large majority of collaborations with educational institutions serve to improve educators' knowledge about business and industry and

the discipline area. A smaller proportion of collaborations with educational organizations serve to improve knowledge of those in business and industry of educational options and opportunities.

- ***Program Improvement.*** Greater numbers of *projects* collaborate with business and industry and educational institutions than with the other two categories of institutions. Most collaborations with business and industry seem to address four topics: student understanding of industry opportunities and requirements; work-based instruction and experience matters (e.g., internships, practica, etc.); student recruitment; and student entry into the workforce. Collaborations with academic institutions included the first three categories plus college/school-based instruction matters.

Reporting *projects* indicate their satisfaction with the quality of these collaborations as illustrated in Table 10. When asked to rate the quality/productivity of collaborations for the four purposes, on average, projects rated productivity from good to excellent for the full array of institutions. Centers, on average, rated productivity from satisfactory to good.

Table 10. Overall Ratings of Quality/Productivity of Collaborations Relative to the Specified Purposes.
n=57: 46 projects (P), 11 centers (C)

General Category		Business or Industry			Public Agencies			Educational Institutions			Other Organizations		
	P or C	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD
General Support	**P**	40	3.48	.78	29	3.07	1.03	41	3.34	.76	21	3.38	.67
	C	11	3.36	.67	8	2.75	1.04	11	3.18	.60	8	3.38	.74
Materials Development	**P**	32	3.25	.80	14	2.86	1.03	34	3.29	.80	13	3.38	.96
	C	10	3.10	.74	7	2.43	.98	11	3.45	.69	5	3.20	.84
Program Improvement	**P**	30	3.23	.73	18	3.06	.80	32	3.31	.82	15	3.13	.92
	C	9	2.89	.33	7	2.57	.79	11	3.09	.54	4	3.25	.50
Professional Development	**P**	34	3.29	.80	19	3.05	.97	35	3.34	.76	17	3.65	.49
	C	11	3.18	.75	7	2.57	.98	11	3.36	.50	6	3.00	.89
		9											

Notes: SD=Standard Deviation; Scale of 1=Poor, 2=Satisfactory, 3=Good, 4=Excellent

Enhancing the Quality of Collaborative Efforts

Because the collaborations between *projects* and various types of institutions and organizations serve as building blocks for accomplishing ATE objectives, we asked *projects* to identify characteristics that improve collaborations. The responses are helpful as a means to assist others who plan to develop collaborative arrangements.

Additionally, respondents' statements regarding barriers tend to confirm the importance of these improvement characteristics.

The characteristics identified as needed for effective collaborations included the quality and enthusiasm of the people involved (18), commitment/interest (16), mutual benefit (14), common purpose/vision (14), and communication including clear expectations (8). The numbers in the parentheses following the various categories identify the number of responses fitting in that category. Table 11 provides example responses from the *projects* that help elaborate and explain what is meant by each category.

Table 11. Characteristics of Effective Collaborations

Quality and Enthusiasm of People Involved
The people involved are the most important factor–their level of commitment**.**
The level of energy that collaborators have to invest in the relationship.
Competent professionals committed to the vision of the project.
The active involvement of company representatives on a regular basis makes some collaborative efforts more effective than others**.**
Commitment/Interest
The "buy-in" or commitment of the individual representatives**.**
Interest in the core ideals of the project; similar needs.
Ownership and buy-in from the personnel assigned to the project**.**
Mutual Benefit
A win-win relationship---where each party clearly benefits.
Goals that serve the interests of each partner**.**
Effective collaborative relationships are built by being able to demonstrate what is in it for all partners and by producing tangible results (graduates being hired by industry, graduates that are highly qualified, etc**.).**
Collaborative initiatives such as * are excellent examples of the synergistic effects of joint ventures**.**
Common Purpose/Vision
Collaborative relationships that attempt to do the following seem to be very effective: Operate with clear, consistent communication among all parties; possess a deep understanding (knowledge) of one another's organizations; and a sincere commitment to work toward mutually established program goals.
The partnership must be based on a common vision and realization that partners have particular assets, talents, knowledge, or other attributes that can help bring the vision to reality.

Table 11. Characteristics of Effective Collaborations
Common Purpose/Vision continued Speedy decision making and convergence of goals. Common goals and clearly defined roles are important factors in successful collaboration.
Communication Including Clear Expectations An honest review of materials and open lines of communications for good feedback**.** Good communication and reliability**.**

The barriers cited most often reflected the effective characteristics and included lack of time (20) and lack of resources or support (e.g., funding, personnel, administrative support) (18). Time is the most prevalently stated reason that collaborations fail. Yet, time consistently interacts with clarity of purpose, priorities, resources, and other matters identified as important to making collaborations productive. This would suggest that the time factor, rather than being the primary barrier, is the reason given most when failure to address other factors crucial to success results in a breakdown of *project* productivity. Table 12 elaborates on these matters and provides several responses that addressed matters or resources, support, and/or time commitments.

Table 12. Barriers to Strong Collaboration and Productivity
Lack of Time Developing curriculum with business/industry "at the table" [not in a review mode only] and engaging in design and development of learning activities that develop specific competencies is very time consuming For business and industry, lack of time and competing priorities are barriers to collaboration with education. The biggest barrier has been a problem in getting the participants from industry to be able to take time away from work for the desired length of time.
Lack of Resources and/or Support Lack of support from college administrations (financial and otherwise); lack of substitute teachers to meet classes during faculty absences; perception that the participation will not impact student learning in individual classrooms; heavy teaching loads and college responsibilities. Lack of developmental funding for pilot assessment projects, and lack of staff to oversee projects. Difficulty finding funding for critical services provided by some community partners. Administrative constraints at home institutions prevent some from implementing creative scheduling and/or facilities in order to carry out the field tests.

Materials Development

ATE *projects* are developing many materials to support the preparation of technicians. These materials include modules (e.g., laboratory exercises) that can be incorporated into coursework, full courses and adaptations of courses.

Nature and Extent of Materials Developed

Projects were asked to report the types of materials being developed, the number of each type under development, and their stage of development. For those materials that are far enough along in the development process to be used, we asked how many were being used locally or at other places and how many had been published commercially. The results of those questions are provided in Tables 13 and 14. As those tables show, the *projects* are developing a large number of instructional materials. The reported numbers in the draft and completed stages alone total 2,375.

Table 13. Total Number of Materials Developed for *Projects* by Type of Materials Developed and Stage of Development
n = 62: 52 projects (P), 10 centers (C)

Type of Materials	Stage of Development		
	Draft	Field Test	Complete
Course Development	79(P) 101(C)	88(P) 105(C)	212(P) 83(C)
Course Adaptation for Implementation	37(P) 36(C)	20(P) 24(C)	76(P) 28(C)
Module Development (a component that can be used in more than one course)*	193(P) 929(C)	181(P) 754(C)	212(P) 283(C)
Other	48(P) 0(C)	422(P) 0(C)	54(P) 4(C)
Total	357(P) 1,066 (C)	711(P) 883(C)	554(P) 398(C)

Notes:
* One center reported 720 modules and 600 modules in the draft and field-test stages, respectively.
The above stage of development categories *are not* mutually exclusive.

An expectation of these development efforts is that the completed products are of good quality, widely disseminated, and used. Table 14 shows that more than 1,700 of these materials were reported in use at least locally. If one presumes all materials developed will be used at least on a local basis, then 35 percent of this total was used at sites other than the *projects,* and 14 percent were commercially published. It should be noted

that some of these materials were modules versus course development or course adaptation. Thus, *projects* may have reported modules both separately and as part of course development or adaptation materials.

Table 14. Total Number of Materials for *Projects* by Usage
n = 62: 52 projects (P), 10 centers (C)

Type of Materials	Local Use (A)	Elsewhere (B)	Commercially Published (C)
Course Development	175 (P) 134 (C)	51 (P) 56 (C)	28 (P) 22 (C)
Course Adaptation	60 (P) 19 (C)	2 (P) 51 (C)	1 (P) 12 (C)
Module Development*	348 (P) 915 (C)	113 (P) 306 (C)	35 (P) 136 (C)
Other	54 (P) 4 (C)	18 (P) 4 (C)	2 (P) 1 (C)

Notes:
* One center reported 720 modules in use locally.
(A): Locally means at sites with the *project*.
(B): Elsewhere means at sites not a part of the *project*.
(A)-(C): *Are not* mutually exclusive categories

To gain an understanding of target audiences and general content of the materials, respondents were asked for descriptive information about each of up to five of their most important materials development efforts. The information requested included (a) title, (b) type of material developed, (c) discipline area, (d) grade level information, and (e) a brief description of the titled material. Table 15 summarizes this information. As this table shows, approximately 80 percent of the developed materials are oriented to the associate degree level, and 18 percent of the materials are targeted at the secondary level. The materials described represent 17 discipline areas. While the strong orientation to the associate degree level is probably representative of all materials development efforts, it is likely that the figures underrepresent the discipline areas for which materials are being developed, since new *projects* (i.e., less than 12 months old) are not represented.

Table 15. Numbers of Materials Summarized by Discipline Area and Grade Level

Discipline (Field of Technology)	Educational Level				Total By Field of Technology
	K-12	College First Year	College Second Year	College Upper Level	
Aquaculture	5				5
Biotechnology	4		3	2	9
Chemical Technology	4	11	9		24
Distance Learning		1	1	1	3
Electronics, Instrumentation, Laser and Fiber Optics		5	1		6
Engineering Technology		12	9		21
Environmental Technology	3	1	3		7
Geographic Information Systems		2			2
Graphics and Multimedia		4	2		6
Information Technology, Telecommunications	4	18	13		35
Mathematics	2	3			5
Manufacturing and Industrial Technology	5	11	8		24
Marine Technology			5		5
General or Multidisciplinary	1	1	1		3
Other	3	4	1		8
Physics	3	11	4		18
Semiconductor Manufacturing			8	1	9
Total Items Developed at Each Educational Level for All Disciplines	34	84	68	4	190

Notes:
Respondents were asked to list up to 5 of the most important materials their *projects* were developing. A combination of 4 types of materials development efforts (total=190) are represented in this table (course development materials [76], course adaptation materials [10], course module materials [72], other types of materials [32])

For the first most important materials development effort, 62 *projects* provided information.
For the second most important materials development effort, 52 *projects* provided information.
For the third most important materials development effort, 41 *projects* provided information.
For the fourth most important materials development effort, 32 *projects* provided information.
For the fifth most important materials development effort, 27 *projects* provided information.

Quality of Materials Development Work

The previously reported items provide some insight to the nature of the materials developed as well as their dissemination and use. The following information directly addresses the element of quality. At best, surveys can only provide proxy evidence of quality. The actual evidence (content validation, student achievement, etc.) must be collected elsewhere to be reported here. The survey solicited information about validation practices on the premise that good practices are likely to lead to good quality materials. Three general measures of quality were used:

1. The use of industry or other relevant standards as a guide to development of materials. Here two items were pertinent. Both help to assure content validity of the materials.

    a. Industry's verification of content alignment with workforce and skill needs
    b. Use of applicable student and industry-based standards or guidelines to guide development of materials

2. Measures of student success. Good assessment measures, built into instructional materials and/or used in conjunction with the developed materials, help to mark student accomplishments and can be used as guides for both instruction and accountability purposes. Five items addressed assessment measures:

    a. Assess student success (knowledge and skills) in comparison with industry/business standards (American Electronics Association Standards, American Chemical Society Standards, etc.)
    b. Assess student success (knowledge and skills) in comparison with educational standards (SMET foundation standards, AMATYC, National Council of Teachers of Mathematics Standards (NCTM), National Research Council Science Education Standards, etc.)
    c. Assess student success (knowledge and skills) in comparison with nontechnical skill standards (e.g., SCANS)
    d. Assess student success (knowledge and skills) in comparison with other nonproject or nonparticipating students
    e. Assess improvement of student performance in the workforce

3. The extent to which the *project* tests its materials (pilot and field-testing[7]) both in development and validations purposes. To address these matters, we used items focusing on the three key types of testing:

[7] Pilot testing refers to brief, preliminary testing of materials or portions of materials and is usually done with a small number of sites. Field-testing refers to testing of materials in settings where they will be used when finalized–usually large and more in-depth than pilot testing.

a. Pilot test materials
b. Field-test materials internally (i.e., within the *project*)
c. Field-test materials externally (i.e., not *project*-based locations)

In each case, respondents were asked to state the frequency with which they used each measure or technique. Their responses are summarized in Tables 16-18. Table 16 suggests substantial compliance with the use of industry or other appropriate standards to guide development of materials. Based on additional data analysis, 73 percent of the projects and 80 percent of the centers report that they use one of the two practices all the time. Only 4 percent of the projects never or nearly never apply such developmental practices.

Table 16. Frequency of Use of Industry Standards or Other Relevant Guidelines for Developing Materials
n = 62: 52 projects (P), 10 centers (C)

Practice	Used Each Time	Used Most Times	Used Less Than Half the Time	Almost Never or Never Used	NA
	%	%	%	%	%
1. Obtain verification by industry regarding alignment of materials with workforce and skill needs	58 (P) 80 (C)	21 (P) 20 (C)	6 (P) 0 (C)	4 (P) 0 (C)	11(P) 0(C)
2. Use applicable student and industry-based standards or guidelines to guide materials development	65 (P) 70 (C)	23 (P) 30 (C)	2 (P) 0 (C)	4 (P) 0 (C)	6 (P) 0 (C)

Because most materials are developed to enhance student learning in identified areas of need for SMET basic skills or industry-based identified areas of need, assessment of student achievement should be considered a requisite for feedback in the developmental process. The varied materials being developed make it appropriate to apply different student assessment methods in the development process. Table 17 reflects the use of these student assessment methods. Upon further data analysis, it was found that 50 percent of the projects and 60 percent of the centers apply one or more of the identified student measures each time. At the other end of the spectrum, 40 percent of projects and 40 percent of centers make little or no use of these student assessment techniques, though they deem them applicable.

Table 17. Frequency of Use of Measures of Student Success
n = 62: 52 projects (P), 10 centers (C)

Practice	Used Each Time %	Used Most Times %	Used Less Than Half the Time %	Almost Never or Never Used %	NA %
1. Assess student success (knowledge and skills) in comparison with industry/business standards (American Electronics Association Standards, American Chemical Society Standards, etc.)	25 (P) 40 (C)	29 (P) 30 (C)	15 (P) 10 (C)	8 (P) 10 (C)	23 (P) 10 (C)
2. Assess student success (knowledge and skills) in comparison with educational standards (SMET foundation standards, AMATYC, National Council of Teachers of Mathematics Standards (NCTM), National Research Council Science Education Standards, etc.)	23 (P) 50 (C)	27 (P) 20 (C)	15 (P) 20 (C)	17 (P) 10 (C)	18 (P) 0 (C)
3. Assess student success (knowledge and skills) in comparison with nontechnical skill standards (e.g., SCANS)	23 (P) 40 (C)	21 (P) 50 (C)	17 (P) 10 (C)	19 (P) 0 (C)	20 (P) 0 (C)
4. Assess student success (knowledge and skills) in comparison with other nonproject or nonparticipating students	17 (P) 20 (C)	25 (P) 20 (C)	12 (P) 30 (C)	21 (P) 30 (C)	25 (P) 0 (C)
5. Assess improvement of student performance in the workforce	17 (P) 30 (C)	17 (P) 30 (C)	15 (P) 20 (C)	19 (P) 20 (C)	32 (P) 0 (C)

Validation is always an important step in development of new materials, but it is especially so in development of materials that are intended to be widely distributed. Two primary steps are routinely taken in validation of materials. The first is called pilot testing. In this process, the developers have persons or groups of persons try out the materials to ensure that the materials are understood, properly employed, learned, and so forth. The second, called field-testing, is routinely done when it is believed the materials are ready for dissemination. This testing ensures such things as (a) that the newly developed materials can be applied by persons who are not privy to development information and (b) that when used the materials result in appropriate student learning. Field-testing is particularly important to the process because often when materials are

applied outside the bounds and influence of the developers, the materials are misunderstood and/or misapplied, leading to poor student learning.

Developers were not asked whether their products performed well under pilot and field-testing conditions. Rather, they were asked only whether they had conducted these tests–not whether student data or just teacher feedback was collected. As such, a positive response does not provide assurance of quality nor does lack of a positive response mean that the quality of the developed materials is poor. However, failure to carefully field-test developed materials does indicate some measure of negligence. As Table 18 shows, more than 80 percent of *projects* reported conducting a pilot and field-test within their own *projects.* Forty-eight percent of projects and 70 percent of centers report conducting external field tests each or most times.

Table 18. The Extent to Which the *Projects* Test Their Materials
n = 62: 52 projects (P), 10 centers (C)

Practice	Used Each Time %	Used Most Times %	Used Less Than Half the Time %	Almost Never or Never Used %	NA %
1. Pilot test materials	61 (P) 50 (C)	21 (P) 30 (C)	6 (P) 10 (C)	2 (P) 10 (C)	10 (P) 0 (C)
2. Field-test materials internally (i.e., within the *project*)	65 (P) 60 (C)	21 (P) 20 (C)	4 (P) 0 (C)	0 (P) 20 (C)	10 (P) 0 (C)
3. Field-test materials externally (i.e., not *project*-based locations)	29 (P) 50 (C)	19 (P) 20 (C)	16 (P) 10 (C)	17 (P) 20 (C)	19 (P) 0 (C)

Developers' Statements of "Most Compelling Evidence of Quality"

Those who completed the Materials Development section were asked to select one item they had developed and state what they considered to be the most compelling evidence for its quality–90 percent of the respondents to this section provided this information. Their comments suggest almost total reliance on reviews and statements of satisfaction by users rather than on concrete evidence of quality. Two factors suggest that conclusion. First, all but two of the responses refer to personal or group testimonials (e.g., employer/industry acceptance/endorsement of the materials [10]; interest on the part of other faculty, peers, students, and publishers [13]; and impact on students not based on collected data [9]) about the quality of the materials. Second, pilot and field-

testing were only discussed in three of the responses, and those did not indicate the collection of data (e.g., student performance data) to establish the material's quality.

Program Improvement

Projects are improving their technician-based programs by constructing new courses, modifying existing courses, and taking steps to better serve students in matters of recruitment, retention, placement, and diversity.

Nature and Extent of Program Improvement

As previously noted, *projects* were funded to develop model programs of instruction at the secondary, associate degree, and baccalaureate levels. Because the general characteristics of program improvement were comparable across the three educational levels, a general form for the program improvement section was prepared and repeated for each level. At each level, respondents were asked to identify a specific program at one specific location and provide additional information about program improvement efforts for that specific case. As a result, at best, the findings provide a rough indicator of total productivity in program improvement. Responses indicated at what program levels improvements are occurring; what kinds and how many courses are undergoing development or change; how many students are enrolled in and completing various courses of study; and the extent to which course credits can be transferred to other institutions.

Fifty-one *projects* responded to the program improvement items. *Projects* located program improvement efforts primarily at the associate degree institutions (see Table 19). Ninety-two percent of the respondents reported program improvement efforts at the associate degree level, 33 percent at the secondary level, and 10 percent at the baccalaureate level.

More than a quarter (28%) of the reporting *projects* conduct programs that engage at least two levels, and 8 percent engage all three levels. In terms of actual number of programs being improved, 21 percent of the work is being conducted through programs that address all three levels. These figures suggest that many *projects* are developing articulated programs across educational levels, chiefly between associate degree institutions and others.

Table 19. Total Number of Programs Developed/Offered by Type of Degree Level or Degree Level Combination n=51: 43 projects (P), 8 centers (C)		
Type of Degree Level or Degree Level Combination	**Projects and Centers Reporting**	**Total Number of Programs Developed or Offered**
Secondary (Exclusively)	4(P)	12(P)
Associate Degree Level (Exclusively)	30(P) 3(C)	101(P) 75(C)
Baccalaureate Degree Level (Exclusively)	0(P)	0(P)
Secondary-Associate	6(P) 3(C)	184(P) 27(C)
Secondary-Baccalaureate	0(P)	0(P)
Associate-Baccalaureate	1(P)	2(P)
Secondary-Associate-Baccalaureate	2(P) 2(C)	89(P) 18(C)
Total	43(P) 8(C)	388(P) 120(C)

Course Development and Modification

Much of program improvement is rooted in course development and/or improvement to bring courses up to date with current workforce needs or to improve course substance in matters of basic science, math, engineering, or technology (SMET). On average, the respondents noted creation of or changes to 6 courses in a secondary program and 11 courses in an associate degree program.

The data suggest that the identified programs are being changed in major ways through development of new courses and changes to existing courses. In combination, about 70 percent of the offerings are undergoing development or modification. New courses total 814, of which 147 are at the secondary level, 646 at the associate degree level, and 21 at the baccalaureate level. On average, a project or center developed 13 courses at the secondary level, 20 at the associate degree level, and 7 at the baccalaureate level. Since some of these *projects* have multilevel courses (e.g., associate and baccalaureate), some of the 814 new courses were reported by the *projects* at more than one degree level. This is also true for changed courses.

Changed courses totaled 554; 74 at the secondary level, 451 at the associate degree level, and 29 at the baccalaureate level programs. On average, a project or center changed 13 courses at the secondary and associate degree levels.

Table 20 provides more specific information about course development and changes at each educational level. For the program and location specified by the respondent, the survey provided an opportunity to identify development work in seven types of courses. For each type, respondents were asked to identify courses developed as part of the grant, courses changed through the grant, and courses that remained unchanged. Table 20 shows that of the 51 *projects* engaged in program improvement, a majority address course development and improvement in basic SMET (science, math, engineering, technology), field-related, introductory technology, and technology-intensive courses. Fewer than a majority engage in development of field-based, certification, and distance courses, with the fewest engaging in development of distance courses. The table also shows that projects consistently produce more new courses than course revisions in the listed categories.

In Table 20, the samples of *projects* that responded to various category options vary in ways that make strong inferences suspect. However, even when taking note of the sample differences, the median responses show substantial changes occurring in these programs. For example, projects indicate a median of 6 SMET courses being developed or changed to 5 courses unchanged. Similarly, centers show 7 new or changed courses to 4.5 left unchanged in SMET. These large change ratios consistently occur across course categories.

Because each respondent reported for only one program and one location at each educational level, undoubtably these findings substantially underestimate the total development and change effort. For participating *projects*, these findings suggest a major overhaul of the SMET and other course offerings.

Table 20. No. of Courses by Type and Category for One Specified Program of *Projects*

Course Category		New Courses (A)			Changed Courses (B)			Unchanged Courses (C)		
	P or C	n	Total no.	Median	n	Total no.	Median	n	Total no.	Median
SMET Courses	P C	25 11	154 56	3.00 3.00	28 8	127 33	3.00 4.00	19 8	157 47	5.00 4.50
Field-Based Courses	P C	12 6	21 13	1.00 2.00	6 5	6 9	1.00 2.00	5 5	8 13	1.00 1.00
Field-Related Courses	P C	26 8	135 23	2.50 2.00	22 7	79 19	2.50 2.00	14 6	78 33	5.00 4.50

Table 20. No. of Courses by Type and Category for One Specified Program of *Projects*										
Course Category		**New Courses (A)**			**Changed Courses (B)**			**Unchanged Courses (C)**		
Certification Courses	**P** **C**	10 5	62 24	2.50 4.00	9 7	52 19	3.00 2.00	7 5	21 17	3.00 3.00
Distance Courses	**P** **C**	12 2	65 14	3.50 7.00	4 2	31 4	1.50 2.00	8 1	20 8	3.00 8.00
Introductory Technology Courses	**P** **C**	18 10	74 24	2.00 2.00	18 7	63 24	2.00 3.00	11 7	21 29	1.00 3.00
Technology Intensive Courses	**P** **C**	24 9	106 43	2.00 3.00	22 7	68 20	2.50 3.00	18 7	103 24	4.50 3.00

Notes:
Course categories are not mutually exclusive
A: Courses added as part of this grant
B: Existing courses that were substantially changed through this grant's efforts
C: Current **specified** program courses that existed as is prior to the start of this **specified** program

Degrees/Certifications and Student Enrollments

As Table 21 shows, the large majority of associate degree institutions provide a degree or certification in technician programs. Though not shown in the table, 43 percent provide both degree and certification options. Similarly, about 35 percent of the secondary institutions offer the two options. None of the five baccalaureate programs offered these options.

Table 21. Characteristics of the *Projects'* Technician Programs by Degree Level			
Program Characteristics	**Secondary School (n=17)**	**Associate Degree Level (n=47)**	**Baccalaureate (n=5)**
A Degree-Based-Major in a Targeted Discipline (n=43)	14%	79%	7%
Certification in a Specific Skill Area (n=33)	36%	64%	0%

Notes:
Each column includes the indicated educational level and all combinations including that level.

Student enrollments were addressed at two levels–*project* wide and for a selected instructional program within a *project*. For *projects* as a whole, some respondents noted that their programs were new and had not yet enrolled students. As illustrated by Table 22, large numbers of students and courses are being impacted by these programmatic changes. The *projects* reported that on average their programs have enrolled a total of 702 and 2,304 persons in their respective secondary and associate degree level courses during the past 12 months.

Table 22. Impact on Courses and Students by Degree Level

ATE Impacted Educational Programs	Median per *Project*	Average per *Project*	Total n for Reporting *Projects**
Number of Institutions/Campuses Where ATE-Impacted Programs Offered	6 (S) 3 (A) 1 (B)	26 (S) 11 (A) 2 (B)	442 (S) 517 (A) 10 (B)
Number of Courses Impacted *Project Wide*	10 (S) 21 (A) 15 (B)	364 (S) 75 (A) 23 (B)	6,188 (S) 3,525 (A) 115 (B)
Number of Students Taking at Least One ATE-Impacted Course in the Past 12 Months**	300 (S) 150 (A) 200 (B)	702 (S) 2,304 (A) 287 (B)	11,934 (S) 108,288 (A) 1,435 (B)

Notes:
S=Secondary (n=17); A=Associate (n=47); B=Baccalaureate (n=5) (Each represents that educational level and all combinations including that level).
*** Total n for Reporting *Projects* = Average x n per educational level**
Example: Secondary No. of Institutions/Campuses Where Offered is 26 (average per *project*) x 17 (n for Secondary)=442.
**** Caveats for the Averages: At the secondary level, two *projects* cited enrollments on the high end of the range (2,000 and 5,000). At the associate degree level, one center reported enrollment of over 70,000, which was confirmed with the center.**

To gain a better understanding of program size and program completions, *projects* were asked to specify the number of students enrolled in and completing a specified program during the last 12 months. At the secondary level, the average enrollment was 98 students with 40 program completers (n=11 respondents). At the associate degree level, the average enrollment was 160 students with 58 program completers (n= 36 respondents).

These are substantial numbers for the participating institutions and, because each responded for only one program at one location, the findings understate the total

numbers involved. However, viewed on a national scale, the number of institutions and students involved are small. The number of institutions impacted must grow substantially if these new programs are to make more than a small dent in the current need for new technicians. Viewed as model programs, it shows the importance of validating and disseminating these new approaches. Only through substantial dissemination of strong programs growing out of these development efforts will NSF meet Congress' mandate for a sufficient and well-trained technician workforce.

Transfer of Course Credits

One issue in the education of technicians is the transferability of training. Someone trained at the secondary school level may want to move to a different school or may want to continue training at a higher level. Removing the structural impediments that slow students in moving through the educational system may therefore increase the numbers of people choosing to become technicians and facilitate training at different levels.

Table 23 addresses transferability of course credits to similar institutions, and Table 24 addresses transferability to a higher degree level institution. These tables suggest that the programs are striving to develop transferability of credits. As might be expected, there is much more transferability within type of educational institution than across.

Table 23. Credit Transfer to Similar Institutions by Type and Projects (P) and Centers (C)

	Secondary (n=17)		Associate (n=47)		Baccalaureate (n=5)	
	Freq.	**Percent**	**Freq.**	**Percent**	**Freq.**	**Percent**
None	1 (P) 0 (C)	8 (P) 0 (C)	2 (P) 0 (C)	5 (P) 0 (C)	0 (P) 0 (C)	0 (P) 0 (C)
Some	1 (P) 1 (C)	8 (P) 20 (C)	7 (P) 1 (C)	18 (P) 12 (C)	0 (P) 1 (C)	0 (P) 50 (C)
Most	4 (P) 1 (C)	33 (P) 20 (C)	12 (P) 5 (C)	31 (P) 62 (C)	1 (P) 1 (C)	33 (P) 50 (C)
All	5 (P) 3 (C)	43 (P) 60 (C)	17 (P) 2 (C)	43 (P) 26 (C)	2 (P) 0 (C)	67 (P) 0 (C)
Don't Know	1 (P) 0 (C)	8 (P) 0 (C)	1 (P) 0 (C)	3 (P) 0 (C)	0 (P) 0 (C)	0 (P) 0 (C)

Notes:
Each column includes the indicated educational level and all combinations including that level.

Table 24. Credit Transfers to a Higher Degree Level Institution by Type and Projects (P) and Centers (C)

	Secondary (n=17)		Associate (n=47)		Baccalaureate (n=5)	
	Freq.	**Percent**	**Freq.**	**Percent**	**Freq.**	**Percent**
None	3 (P) 2 (C)	25 (P) 40 (C)	2 (P) 0 (C)	5 (P) 0 (C)	0 (P) 0 (C)	0 (P) 0 (C)
Some	2 (P) 0 (C)	17 (P) 0 (C)	13 (P) 3 (C)	33 (P) 37 (C)	0 (P) 0 (C)	0 (P) 0 (C)
Most	3 (P) 1 (C)	25 (P) 20 (C)	12 (P) 3 (C)	31 (P) 37 (C)	0 (P) 1 (C)	0 (P) 50 (C)
All	4 (P) 1 (C)	33 (P) 20 (C)	11 (P) 2 (C)	28 (P) 26 (C)	2 (P) 0 (C)	67 (P) 0 (C)
Don't Know	0 (P) 1 (C)	0 (P) 20 (C)	1 (P) 0 (C)	3 (P) 0 (C)	1 (P) 1 (C)	33 (P) 50 (C)

Notes:
Each column includes the indicated educational level and all combinations including that level.

Ethnic and Minority Representation

Table 25 shows reported estimated enrollments in the technical programs at the secondary, associate, and baccalaureate degree levels. At best, these estimates are crude indicators because many *projects* did not provide data for some of the variables. In several cases, *projects* noted that they were just beginning their programs, and no students would be enrolled until the fall term. Note that in the case of minority and white students, which one would expect to total to100 percent, the total falls short for the three degree levels.

Table 25. Proportion of Students Enrolled in Academic Programs During the Past 12 Months by Student Category and Degree Level			
Student Descriptor	**Secondary Level (n=17)**	**Associate Degree Level (n=47)**	**Baccalaureate (n=5)**
Female	20%	29%	26%
Minority (Hispanic or Latino, American Indian or Alaska Native, Asian, Black or African American, Native Hawaiian or other Pacific Islander)	52%	40%	52%
White	43%	42%	27%
Percent of Students Who Requested Accommodation Due to Their Disability under the Americans with Disabilities Act.	7%	2%	8%
Notes: **Each column includes the indicated educational level and all combinations including that level.**			

Recruitment and Retention

When respondents were asked to describe their program's recruitment efforts and retention strategies, their responses were quite varied. Of the 59 strategies for retention, the most popular were tutoring (21), financial support (19), and academic advising/counseling (13). Ten *projects* reported that recruitment and retention were not applicable or information was unavailable.

One goal of the ATE program is to increase the diversity of the workforce. It appears that *projects* are mixed in their responses to dealing with diversity. The quotes below represent the range of responses to the item about diversity, from not providing any information or indicating that diversity is not being addressed (15) to various strategies, including new ones for ATE and the use of existing programs within the funded institution.

"We have done nothing explicit."

"Focusing on understanding the underrepresentation and the possible mechanisms for overcoming it in the research itself."

“The colleges each have internal programs to recruit and retain underrepresented groups.”

“The project is designed to serve individuals from high poverty communities, nearly all of whom are members of minority groups.”

“The department has worked directly with the Student Recruitment and Job Placement Offices, whose programs are funded by Perkins grant funds.”

Table 26 provides examples from the range of descriptions for recruitment strategies.

Table 26. Example Descriptions of Recruitment Activities at the Associate, Secondary, and Baccalaureate Degree Levels
Associate Degree Level
Use of brochures, invited speakers, participation in high school career days, mail-out of letters to all health science applicants who did not get selected for competitive programs.
We used our website, posted flyers throughout campus and the community, attended job fairs, presented in other classes and presented information to all college counselors.
Linking program to Tech Prep programs at school districts in the region.
A high school level program exists---most students recruited here through a Career Academy approach.
Scholarships, publicity articles in local and regional newspapers, technical Olympics where students in high school can win scholarships, site visits to high schools, College Day, brochures, video.

Table 26. Example Descriptions of Recruitment Activities at the Associate, Secondary, and Baccalaureate Degree Levels
Secondary Level
Career Seminars, peer visits, visitations, day on the job.
Go to 25 middle schools to speak to 8th graders (about 250 total students) to describe benefits of program and show video.
Mass mailings to all public secondary schools in the *; local, regional, and national conference presentations, magazine advertisements.
High school personnel met with parents and students to explain the new dual-credit Technology Gateway offering.
We are planning to work with a group of high school students (82 students) of which 65% are minority and 15% are female.
Baccalaureate
Admissions brochures, college career days **.**
Presentations to * employees.
Notes: Some items were edited to correct spelling. Asterisks (*) were also substituted for specific *project* or program names.

Placement of Program Completers

Table 27 provides a snapshot *project* estimate of the proportion of students who took technician positions upon completion of the program or continued their education. At the associate degree level, 46 percent of the students were identified as taking a technician position and 28 percent are going on to higher education for *projects* (not mutually exclusive categories).

Open-ended responses (Table 28) support the perception that students who complete these programs do find work. Fourteen of 69 reporting *projects* noted that placement of students was not applicable to their particular program improvement. Two indicated that their programs had not yet started. The remaining *projects* identified a variety of activities or indicated that placement support is not needed because their graduates and/or students are in such high demand.

Table 27. Reported Average Proportion of Program Completers Who Take Jobs in Technology or Continue Their Higher Education by Degree Level

	Secondary School Level (n=17)	Associate Degree Level (n=47)	Baccalaureate (n=5)
Technician Positions	19%	46%	26%
Higher Education	55%	28%	30%
Number of Student Completions per School Program	40	58	55

Notes: Each column includes the indicated educational level and all combinations including that level.

Table 28. Example *Projects'* Steps Taken to Place Students in Workforce Positions

Advertise program and write articles about the quality of the students in the program to encourage industry to hire graduates.
We actively work with industry to place students in internships.
Working with local industries through personal contacts; working with scientific job placement agencies.
We actually placed students when requested by industry and utilized the internship program to place others.
Department has many connections with local, regional, and some national *-based industries.
Facilitate placement through college placement office--direct calls from employers seeking employees.
Students are very marketable so that some leave the program for jobs requiring * skills before completing the program.
There is typically 100% placement for all students seeking employment upon graduation.

Notes: Some items were edited to correct spelling. Asterisks (*) were substituted for specific *project* or program names.

Professional Development

Projects conduct large numbers of professional development activities for faculty. These activities are well attended and well received.

Nature and Extent of Professional Development

The section of the survey on professional development included 6 items that asked:

- Number of professional development opportunities and number of participants
- Percentages of participants who engage in implementation behaviors after participating in professional development
- Numbers of participants from the different educational levels
- How full the professional development opportunities are
- What sort of support is provided to professional development participants
- What outcomes have resulted from the professional development opportunities

Forty-seven (47) projects and 11 centers provided information about professional development. As would be expected, however, not all *projects* were engaged in all types of professional development, so the numbers of *projects* varied substantially across items and components of items.

Table 29 shows that in the past 12 months, conferences, workshops and in-service courses were the most popular forms of professional development. Conferences were defined as a multiple track selection of workshops or presentations; workshops as a single track, 1-to-3 day directed learning experience; and in-services as a course or seminar longer than a 3-day directed learning experience. *Projects* report providing a total of 475 large-group offerings, divided among conferences (125), workshops (239), and in-service courses (111). Additionally, much smaller numbers of *projects* provided internships for faculty, on-line courses, and other learning activities (e.g., over half the centers and about a quarter of the projects provided internships). Substantial numbers of participants attended the three types of sessions for the large-group offerings with medians for attendance ranging from 11-22 for projects and 29-130 for centers. As these numbers suggest, reported center large-group activities tended to include more participants—2 to 12 times as many as the typical project.

When asked how full the professional development opportunities were, 47 projects and 11 centers responded. For projects, 41 percent were at or near full capacity, 36 percent were at or about 75 percent capacity, 19 percent at half capacity, and 4 percent reported operating at less than half of their capacity. For centers, 36 percent were at or near full capacity, 55 percent were at or about 75 percent capacity, and 9 percent were at half capacity.

Table 29. Conference Opportunity and Participation Rates in the Past 12 Months (Projects (P) and Centers (C))						
	Number of Opportunities			Number of Participants		
	Reporting (n)	Range	Median	Reporting (n)	Range	Median
Conferences	25 (P) 9 (C)	0-18 (P) 0-15 (C)	2 (P) 2 (C)	24 (P) 9 (C)	0-1000 (P) 0-700 (C)	11 (P) 130 (C)
Workshops	33 (P) 10 (C)	1-45 (P) 1-21 (C)	3 (P) 5 (C)	32 (P) 10 (C)	1-525 (P) 30-471 (C)	22 (P) 110 (C)
In-service for Faculty	27 (P) 7 (C)	0-20 (P) 1-6 (C)	2 (P) 1 (C)	26 (P) 7 (C)	0-164 (P) 14-103 (C)	16 (P) 29 (C)
Internship	14 (P) 6 (C)	0-4 (P) 0-15 (C)	1 (P) 2 (C)	12 (P) 6 (C)	0-30 (P) 0-75 (C)	2 (P) 5 (C)
On-Line	11 (P) 3 (C)	0-25 (P) 1-16 (C)	1 (P) 1 (C)	9 (P) 2 (C)	1-2000 (P) 15-127 (C)	2 (P) 71 (C)
Other	8 (P) 1 (C)	0-100 (P) 3-3 (C)	2 (P) 3 (C)	8 (P) 1 (C)	0-42 (P) 18-18 (C)	17 (P) 18 (C)

The numbers of participants were also broken out by educational level (i.e., level at which participants were teaching). These data are presented in Table 30 and show that the 2-year colleges recorded the largest participation rates, both in terms of median and total numbers of participants, followed closely by secondary faculty.

Table 30. Range and Median of Numbers of Participants by Educational Level and Numbers of Projects (P)/Centers (C) Reporting			
Educational Level	***Projects* Reporting (n)**	**Number of Participants (Range)**	**Number of Participants (Median)**
Secondary	37 (P) 11 (C)	0-900 (P) 8-259 (C)	10 (P) 30 (C)
2-year	43 (P) 11 (C)	0-1300 (P) 19-278 (C)	14 (P) 100 (C)
4-year	31 (P) 10 (C)	0-50 (P) 0-23 (C)	2 (P) 8 (C)
Other	12 (P) 5 (C)	0-120 (P) 10-100 (C)	2 (P) 20 (C)

Use of Implementation Strategies

Sound professional development requires more than just presentation of new ideas. These ideas must be accepted, and participants must be able to take home and implement what they have learned. Our survey form asked respondents to report their findings on these matters. Table 31 presents the percentages of participants reported

by the projects and centers as engaging in various implementation strategies. Generally, the highest percentages are found for participants indicating satisfaction with the professional development activity, although all percentages are fairly high. Reported satisfaction of the participants with these efforts is high, which bodes well for implementation. Typically, where follow-up has occurred and has been reported, about 38 percent of the participants try out the materials and a third incorporate them into their classrooms.

Table 31. Participant Feedback on *Project* Sponsored Professional Development Activities (Projects (P), Centers (C))

Professional Development Activity	Indicated Satisfaction with the Activity		Indicated Intention to Use the Technology, Materials, And/or Major Ideas Presented		Tried Out the Technology, Materials, and/or Major Ideas at Least Once in the Classroom		Fully Incorporated the Technology, Materials, and/or Major Ideas into Their Course or Program	
	Av. %	**n**	**Av. %**	**n**	**Av. %**	**n**	**Av. %**	**n**
Conferences	90% (P) 89% (C)	20 (P) 7 (C)	78% (P) 91% (C)	19 (P) 4 (C)	67% (P) 83% (C)	16 (P) 3 (C)	41% (P) 67% (C)	15 (P) 3 (C)
Workshops	79% (P) 89% (C)	30 (P) 8 (C)	73% (P) 86% (C)	27 (P) 6 (C)	60% (P) 78% (C)	24 (P) 7 (C)	40% (P) 53% (C)	20 (P) 5 (C)
In-service	83% (P) 88% (C)	21 (P) 6 (C)	78% (P) 87% (C)	20 (P) 5 (C)	66% (P) 80% (C)	13 (P) 3 (C)	56% (P) 62% (C)	15 (P) 2 (C)
Internship for Faculty	69% (P) 80% (C)	6 (P) 4 (C)	69% (P) 100% (C)	6 (P) 3 (C)	52% (P) 88% (C)	6 (P) 4 (C)	43% (P) 50% (C)	5 (P) 1 (C)
On-Line	65% (P) 67% (C)	7 (P) 2 (C)	65% (P) 68% (C)	6 (P) 2 (C)	65% (P) 55% (C)	5 (P) 2 (C)	81% (P) 80% (C)	5 (P) 1 (C)
Other	60% (P) 100% (C)	4 (P) 1 (C)	69% (P) 90% (C)	5 (P) 1 (C)	55% (P)	5 (P) 0 (C)	55% (P)	6 (P) 0 (C)

Notes: Percent values reported in the table cells are averages of percents reported by projects and centers. Reported ns are the number of projects and centers that reported on the professional development activity.

Professional development experts (e.g., Guskey, 1999) state (a) that strong professional development requires follow-up from the initial activity (e.g., workshop) to facilitate and support implementation at the institution where the ideas and materials are to be implemented and (b) that the local institution provide support to the implementers in the trial and adoption process. Lower response rates regarding matters of trial and implementation (38 percent of *projects* responding to this section) suggest that a large proportion of the *projects* either fail to provide such follow-up or fail to assess the effects of their efforts.

Less than half the projects ask participants' local institutions for support, but when they do, it tends to be given. Forty-three percent of the *projects* reported asking for support

from the participants' home institutions. In those cases the large majority, approximately 88 and 68 percent for associate and secondary, respectively, reported that such assistance was provided.

The *projects* also provide support to their professional development participants. The most common type of support was technical assistance, which was provided by 71 percent of the 58 *projects*. The next most common was materials, which were provided by 69 percent of the *projects*. These were followed by money at 45 percent and equipment at 33 percent.

Outcomes of Professional Development

This section of the survey contained one open-ended item that stated: "For each educational level for which your center/project has provided professional development activities, please comment on your program's effectiveness. That is, briefly describe what faculty can do now as a result of participation in professional development activities that they could not do before. If possible, please provide an example or two." Respondents were asked to comment for each of the three educational levels (i.e., secondary, 2-year college, and 4-year college/university).

The responses to this item were very similar across *projects* and addressed many of the same topics (categories) for all three educational levels. The most commonly noted categories were course improvement, knowledge of technology, increased understanding of industry, and opportunity for networking. Table 32 provides a qualitative grouping of the items for the different levels, each with a sample response.

Table 32. Outcomes Categories and Examples of Outcomes Reported by Type of Institution

Categories	Examples
Secondary-Course Improvement	Improve programs, teach contextually, and have quality curriculum available.
Secondary-Increased Knowledge of Technology	Faculty can make effective use of distance learning technology to enhance student learning opportunities.
Secondary-Increased Understanding of Industry	Secondary school faculty are now more familiar with the application of biotechnology to different fields.
Secondary-Networking	High school faculty benefit from interaction with college educators, gaining insight into what their students will need to know next.
2 Year-Course Improvement	Faculty have implemented new modules into existing courses.
2 Year-Increased Knowledge of Technology	Faculty members have received training in current biotechnology techniques and bioinformatics.
2 Year-Increased Understanding of Industry	Through the annual Faculty Workshop held in August each year, the faculty are exposed to industry tours, industry training by industry experts, and industry experts presenting current and future technology trends.

Table 32. Outcomes Categories and Examples of Outcomes Reported by Type of Institution	
Categories	**Examples**
2 Year-Networking	There is a special peer interaction that leads to ongoing dialog and requests for help.
4 Year-Course Improvement	University faculty now know how to add case studies into their curricula and how to incorporate critical thinking and problem-based learning into their classrooms.
4 Year-Increased Knowledge of Technology	Use authoring systems software to develop web-based instruction for their courses.
4 Year-Increased Understanding of Industry	Four-year college faculty benefit from new ideas on teaching chemistry and chemical technology.
4 Year-Networking	Development of collaborative opportunities.

COMPARISON OF THE 2000 AND 2001 SURVEY FINDINGS

In this section we compare results from the 2000 and 2001 surveys as a first step toward identifying long-term trends. Our purpose is to begin looking for patterns–data that are consistent and data that appear to be changing. A two-year period is too brief a time to identify clear patterns, but it does provide some early indicators.

As has been mentioned previously, a survey of the active ATE *projects* was conducted in May 2000 (n=113) and then again in February 2001 (n=81). The substantially smaller 2001 sample number was due to a change in our sampling rule. In 2000, all current *projects*, except those that participated in the survey walk-through pilot process, were included in the sample. In 2001, only current *projects* that had been funded for a period of at least 12 months were included. The resulting 2001 sample had three characteristics important to interpreting cross-year findings.

- The *projects* sampled in 2001 were more mature as a group (i.e., the *projects* had been in place longer) than those sampled in 2000.
- The 2001 respondents better understood the survey requirements and had more opportunity to prepare than did the 2000 respondents.
- Approximately 70 percent of the *projects* sampled in 2000 were included in the 2001 sample. More importantly, the 2001 sample is nearly a subset of the 2000 sample (96 percent of the 2001 sample was also sampled in 2000).

In this section, this comparison, drawn from the *Status Report 2* and this report, begins with a brief section on the nature and scope of activity and then is organized around the four primary work categories–collaborations, materials development, program improvement, and professional development.

Overview–Nature and Scope of Activity

Work Categories

The nature of the work conducted by the *projects* in both years was very similar as illustrated in Table 33. Additionally, in each year, approximately 70 percent of these *projects* were involved in at least 3 of the 4 work categories. A caveat on this apparent trend is that slightly more *projects* were engaged in at least 2 of the 4 work categories in 2001 than in 2000 (94 percent vs. 85 percent).

As described on page 4, the percent of *projects* engaging in collaborations is most likely underreported. Also, though not identified as separate categories on the survey, materials development is typically conducted either for commercial distribution or program improvement. Based on the number of *projects* that filled out this section but did not complete the program improvement section, we estimate that approximately 20 percent of the *projects* focus on materials development for commercial dissemination.

Table 33. Percent of *Projects* Engaged in the Four Work Categories–2000 and 2001

Work Category	Year 2000 Percent of *Projects*	Year 2001 Percent of *Projects*
Materials Development	82	83
Collaborations	75	76
Professional Development	74	77
Program Improvement	63	67

Project Stability

Looking at both years, there were similar findings for the eight *project* stability factors as detailed in Tables 34 and 35 (Note: Two items addressing professional development were added in 2001). In both years, the *projects* were at stable or increasing across all eight factors, and the large majority of *projects* showed either some increase or substantial increase for the important matters of use of *project* products, direct participation by institutions and organizations, students enrolled, and students placed in technical jobs.

A closer look at the centers (Table 35) reveals that these entities appeared to be stabilizing on the factors of staff size, financial support from other organizations, direct participation by other institutions and organizations, student enrollment, and number of students graduating or completing programs. In 2001, more of these centers viewed

themselves as stable on these factors rather than showing an increase or substantial increase with a net result of about the same percentage for these two categories. For example, nearly 20 percent of the centers that reported their financial support as increasing in 2000 reported their financial support as stable in 2001. Thus, the majority of centers, 55 percent, reported stable financial support in 2001. This possible stabilization may be attributable to the maturity of centers, since many of the centers responding to the survey were in their second round of funding.

Table 34. Project Ratings of Current Status Versus Status a Year Ago–2000 and 2001
(N=76 for 2000, N=64 for 2001)

Factor	2000 n*	2001 n**	Stable (%) 2000	Stable (%) 2001	I or S-I (%) 2000	I or S-I (%) 2001
Size of staff	66	59	63	69	21	16
Collaborations						
Financial support from other organizations	55	53	60	61	31	32
Direct participation by other institutions and organizations	66	57	32	41	67	56
Materials Development						
Income from center/project-developed products	14	14	64	50	29	36
Use of center/project-developed products	57	45	26	31	72	69
Program Improvement						
Students enrolled	51	45	31	31	59	58
Students placed in related technical jobs, whether they completed program or not	36	33	44	37	56	60
Students graduating or completing the program	36	35	29	37	56	51

Notes: I= Some Increase (5-20%), S-I=Substantial Increase (>20%)
* For 2000, individual item ns = 76 - no. of Not Applicable Responses
** For 2001, individual item ns = 64 - no. of Not Applicable Responses
Please see Table 2 (p. 7) for a detailed breakdown of all categories for 2001.

Table 35. Center Ratings of Current Status Versus Status a Year Ago–2000 and 2001
(N=8 for 2000, N=11 for 2001)

Factor	2000 n*	2001 n**	Stable (%) 2000	Stable (%) 2001	I or S-I (%) 2000	I or S-I (%) 2001
Size of staff	8	10	12	40	38	20
Collaborations						
Financial support from other organizations	8	11	38	55	52	36
Direct participation by other institutions and organizations	8	11	12	27	88	64
Materials Development						
Income from center/project-developed products	6	8	33	37	67	63
Use of center/project-developed products	7	11	14	9	86	91
Program Improvement						
Students enrolled	6	9	17	45	83	55
Students placed in related technical jobs, whether they completed program or not	6	6	17	17	83	83
Students graduating or completing the program	5	9	20	45	80	44

Notes: I= Some Increase (5-20%), S-I=Substantial Increase (>20%)
* For 2000, individual item ns = 8 - no. of Not Applicable Responses
** For 2001, individual item ns = 11 - no. of Not Applicable Responses
Please see Table 3 (p. 8) for a detailed breakdown of all categories for 2001.

Unintended Outcomes and Barriers/Challenges

In both years, all the reported outcomes were viewed as primarily positive in nature and consistently addressed three categories–(1) partnerships, networks, collaborations; (2) applications to other disciplines/work with other disciplines; and (3) additional funding received. Year 2000 respondents' comments regarding full enrollments were not made by 2001 respondents.

The barriers/challenges cited by survey respondents were also consistent in 2000 and 2001–(1) lack of time, money, other resources; (2) lack of administrative support; (3) ability to attract/keep faculty and other critical staff members; (4) communication and coordination; and (5) faculty having difficulty adapting to the changes needed for the new programs. Please see Tables 4 and 5 (pp. 9-11) for relevant comments made in 2001.

Evaluation

Evaluation efforts remained consistent over both years. In each year, more than 80 percent reported use of a *project* evaluator, with about 75 percent external to the respective *project* and around 20 percent indicating use of both an external and internal evaluator. In response to whether they had completed the important evaluative task of conducting a needs assessment, each year more than 80 percent reported having completed one to serve *project* needs. Approximately 75 percent reported completing these assessments prior to *project* commencement, and about 50 percent completed their assessments after they received funding (not mutually exclusive categories).

Collaborations

Nature and Extent

Looking at both years, the *projects* continued to establish many partnerships that served multiple purposes and provided monetary and in-kind support for the programs. In each year, the typical (average) project maintained more than15 separate collaborative efforts with business/industry or other organizations or institutions (please see p. 15 for a detailed discussion for survey 2001). Approximately a quarter of the collaborations are general in nature, providing advice, general assistance, and equipment. The large majority are intended to serve materials development, program improvement, and professional development purposes (please see Tables 8 and 9, pp. 15-17, for additional detail from survey 2001).

In each year, more than 60 percent of the *projects* reported collaborations with four or more types of institutions (i.e., business and industry, public agencies, professional societies, secondary education, associate degree level education institutions, and baccalaureate degree colleges or universities). Projects indicated that their most prevalent type of collaboration was with business and industry (around 80 percent), followed by associate, secondary, and baccalaureate degree colleges or universities (at least 50 percent for each type). All the centers collaborated with four types of groups–business and industry, associate, secondary, and baccalaureate degree colleges or universities.

In both 2000 and 2001, the large majority of *projects* (about 75 percent for projects, 100 percent for centers) used collaborations with business and industry for general advice purposes. Most *projects* also worked with business and industry in the early stages of

materials development (e.g., determination of content and specifying standards), but a smaller proportion were engaged in the pilot and field-testing efforts. The majority of centers and the majority or near majority of projects worked with educational institutions in all phases of materials development from determination of content through testing of completed products. These last two findings are consistent with business/industry (vs. educational institutions) typically having fewer opportunities for involvement in pilot and field-testing efforts.

For professional development, collaborations with business and industry in both years most frequently served development of faculty knowledge of industry needs and opportunities and, correspondingly, business and industry knowledge regarding educational options and opportunities. The large majority of collaborations with educational institutions served to improve educators' knowledge about business and industry and the discipline area.

Greater numbers of *projects* collaborated with business and industry and educational institutions than with public agencies or other organizations for program improvement efforts in each year. Most collaborations for program improvement with business and industry seemed to address four topics: student understanding of industry opportunities and requirements, work-based instruction and experience matters (e.g., internships, practica, etc.), student recruitment, and student entry into the workforce.

Monetary and In-Kind Support

As illustrated in Table 36, direct contributions of money from non-NSF sources remained relatively constant (around $12-$14 million) in both years. In each year, *projects* reported leveraging NSF's funds with additional monetary and in-kind contributions from non-NSF sources. For every dollar provided by NSF for the duration of the *projects'* grant periods, the *projects* reported increasing their working resources for the ATE program by 50 cents in 2000 and by 80 cents in 2001. Two factors probably contributed to this increase: (a) *projects* likely tracked their collaborations better for the 2001 survey, since these *projects* knew a year in advance that they must track this data and (b) the 2001 responding *projects*, because they had completed one more year of work, tended to have more established collaborations than in 2000.

Table 36. Monetary and In-Kind Contributions to *Projects*–2000 and 2001				
	Total Monetary Support Received to Date 2000 ($)	**Total Monetary Support Received to Date 2001 ($)**	**Estimated Monetary Value of In-Kind Support 2000 ($)**	**Estimated Monetary Value of In-Kind Support 2001 ($)**
Total from All Non-NSF Sources (A)	13,696,102	12,204,587	16,287,171	24,017,001
Total NSF # for Reporting *Projects* (B)	59,739,241	45,387,167	59,739,241	45,387,167
Cost Sharing Percentage (A/B x 100)	23%	27%	27%	53%
Note: For 2000, n=67 (58 projects and 9 centers) For 2001, n=57 (46 projects and 11 centers)				

The Quality of Collaborative Efforts

Looking at both years, the *projects* consistently rated the quality of their collaborations with business and industry, public agencies, educational institutions, and other organizations for the purposes of general support, materials development, program improvement, and professional development. Projects viewed these collaborations as good to excellent, while centers saw them as satisfactory to good (see Table 10, p. 18 for 2001's detailed information).

The elements needed for effective collaborations identified by the *projects* were similar in both years: (1) the quality and the enthusiasm of the people involved, (2) commitment/interest, (3) mutual benefit, (4) common purpose/vision, and (5) communication including clear expectations. Table 11, pages 19-20, provides example responses from the 2001 survey respondents. Similarly, lack of time and lack of resources/support were identified by 2000 and 2001 survey respondents as leading barriers to successful collaborations.

Materials Development

Nature and Extent

The *projects* continued to develop a large number of instructional materials. In each year, more than 1,000 of these materials were reported in use at least locally. If one presumed all materials developed were used at least on a local basis, then in each year, at least 35 percent of this total was used at sites other than the *projects,* and 11 percent were commercially published. It should be noted that some of these materials were modules versus course development or course adaptation. Thus, *projects* may have reported modules both separately and as part of course development or adaptation materials. The large majority of materials (80%) appeared to be oriented to the associate degree level, although *projects* reported that about 18 percent of the materials were targeted at the secondary level (please see Table 15, p. 23).

Quality of Materials Development Efforts

Most *projects* apply sound practices to determine content and try out their materials, but they could focus more attention on comprehensive validation efforts (i.e., external field testing, use of concrete evidence). The reported efforts include:

- In both years, more than 65 percent of the projects and 75 percent of the centers reported that they either obtained verification by industry regarding alignment of materials with workforce and skill needs or used applicable student and industry-based standards or guidelines to guide materials development.
- In each year, more than 50 percent of the projects and 60 percent of the centers report applying one or more of five identified student measures of success to validate their materials each time materials are developed.
- More than 80 percent of *projects* reported that they pilot or field-tested within their own *projects* each or most times.
- About half of the *projects* reported conducting external field tests.
- When asked to describe their most compelling evidence of quality for developed materials, the large majority indicated their reliance on reviews and statements of satisfaction by users rather than on concrete evidence based on collected data (e.g., student performance data).

Program Improvement

Nature and Extent

Looking at both years, nearly all program improvement efforts (more than 90 percent in both years) reportedly had their locus at associate degree institutions, with more than 33 percent at the secondary and 10 percent at the baccalaureate levels, respectively (not mutually exclusive categories). However, the proportion of *projects* engaged in at least two levels of program improvement (i.e., secondary and associate levels) dropped

from about half in 2000 to slightly more than a quarter of the *projects* in 2001. This change may be a function of both small shifts in *project* directions and respondents' misunderstandings in responding to the survey in 2000 (i.e., some appear to have responded to items at educational levels not consistent with their actual program improvement efforts). These figures suggest that many *projects* are developing articulated programs across educational levels, chiefly between associate degree institutions and others.

Course Development and Modification

Respondents were asked to identify a specific program at one specific location and provide program improvement information for this program for the past 12 months**.** For these courses, *projects* reported that 70 percent of their course offerings were under development or modification in 2001, a 16 percent increase over 2000.

- In both years, the majority of responding *projects* addressed course development and improvement in basic SMET (science, mathematics, engineering, and technology), field-related, and technology-intensive courses.
- Less than a majority engaged in development of field-based, certification, and distance courses, with the fewest in development of distance courses (27 percent in 2001).
- In 2001, 55 percent of the *projects* reported introductory technology course development and improvement, a 15 percent increase over 2000. Participant *projects* visited for our case study conducted in late 2000 and early 2001 shared with us that the interest generated by their programs had resulted in other departments requesting access to introductory technology courses. Such influences likely accounted for some of this increase.

Degrees/Certifications and Transfer of Credits

In both years, a large majority of the associate degree institutions provided either a technician degree or certification program; in each year, more than 40 percent provided both. In 2001, the percent of secondary institutions indicating that these two options were offered doubled (35 percent vs. 17 percent). This could have been the result of the *projects* implementing articulation agreements and/or better data collection and reporting.

In each year, a large proportion of institutions provided for transfer of credit across institutional types. However, educational institutions consistently provided for better transfer of courses within than across type of institution. More than 50 percent of projects and 60 percent of centers indicated that their credits transferred to higher institutions most or all the time. In both years, more than 65 percent of projects and 70 percent of centers reported that credits could be transferred to similar institutions (e.g., from one associate degree institution to another) most or all the time.

Student Enrollments and Student Representation

Student enrollments were addressed at two levels–*project* wide and for a selected instructional program within a *project*. By both measures, enrollments increased substantially from 2000 to 2001.

For *projects* as a whole, average enrollments reported for the past 12 months more than doubled in the secondary and associate degree level courses (700 in 2001 vs. 244 in 2000 for secondary; 2,300 in 2001 vs. 915 in 2000 for associate). These increases appeared to be due largely to a few institutions rather than an across-the-board increase. For example, at the secondary level, two *projects* reporting for the first time in 2001 cited enrollments on the high end of the range (2,000 and 5,000). Similarly, in 2001, one center reported enrollment of around 70,000[8] in its associate level programs.

When viewed for the within-*project* specified program conducted during the last 12 months, *projects* reported that their average enrollment rose substantially in 2001 (e.g., 94 to 160 students at the associate degree level). In these specified programs, the average number of program completers also increased from 43 to 58 in 2001.

Representation of women and minorities held steady in both years. Around 30 percent of enrolled students were women, and more than 35 percent were minority at the associate degree level institutions.

Recruitment and Retention

Recruitment efforts reported by the *projects* were similar in both years. Many were tied to existing efforts at the institutions where the programs were housed (see Table 26, pages 36-37, for some examples from the 2001 survey). *Project* responses indicated that their recruitment efforts had mixed results in matters of increasing the diversity of the workforce. Various strategies were identified and some *projects* focused on recruiting underrepresented groups, while other *projects* reported no recruitment efforts (please see page 36 for examples from the 2001 survey).

In each year, more than 50 strategies for retention were reported by the *projects*. Three general strategies emerged for these efforts–tutoring, financial support, and academic advising/counseling.

Placement of Program Completers

The proportion of students who took technician positions upon completion of their programs dropped, from 73 percent reported in 2000 to 46 percent in 2001. However, the proportion of students who continued their education remained around 30 percent

[8]This enrollment figure was verified with the center.

(not mutually exclusive categories) in both years. *Projects* continued to identify various activities to assist with placement or to indicate that placement support was not needed because their graduates and/or students were in such high demand (see Table 28, page 38, for 2001's examples of placement activities). Whether the drop in the proportion of students placed in technician positions was due to the recent economic downturn in the technology sector or another factor (e.g., more students in the first year of a 2-year degree program in 2001 than in 2000) remains to be determined.

Professional Development

Nature and Extent

Professional development opportunities for faculty continued to attract many participants and were well attended and received. In 2000 and 2001, conferences, workshops, and in-service courses remained the most popular forms. While the number of *projects* reporting remained relatively constant in both years of the survey, the reported number of these large course offerings dropped from 648 to 475 in 2001. Most of this drop can be attributed to workshops–two centers reported having 140 fewer workshops in 2001 than in 2000. The number of conferences and in-service courses remained relatively constant at around 125 and 110, respectively.

In both years, the large course offerings were well attended with a median of around 20 individuals for projects and about 130 for centers (see Table 29, page 40, for 2001's detail). Most participants were from associate degree granting institutions (medians of 14 from projects, 100 from centers), followed closely by secondary faculty (medians of 10 from projects, 30 from centers). Regarding how full their professional development opportunities were in both years, more than 75 percent of the projects reported they were at least at 75 percent capacity, and more than 90 percent of centers reported this level of capacity.

Use of Implementation Strategies

Sound professional development requires more than just presentation of new ideas. These ideas must be accepted, and participants must be able to take home and implement what they have learned. Our survey form asked respondents to report their findings on these matters. Over both years of the survey, *projects*' professional development participants reported high levels of satisfaction with the professional development opportunities. However, less than a majority of the *projects'* professional development participants reported trying out materials, and fewer than a third of these participants reported incorporating what they learned into their classrooms.

Professional development experts (e.g., Guskey, 1999[9]) state that strong professional development requires local institutional support for the implementers and follow-up from the initial activity. Most respondents reported providing support to their participants in both years and consistency in types of support provided. Table 36 summarizes the most common types of support. In each year, fewer than half the *projects* reported asking participants' local institutions for support. However, of those who asked, the large majority reported that such assistance was provided. Most *projects* did not report direct follow-up of their professional development instruction. In both years, fewer than half of the *projects* responded in matters of trial and implementation. This suggests that a large proportion of the *projects* either failed to provide such follow-up or failed to assess the effects of their efforts.

Table 36. *Project* Support for Professional Development Participants–2000 and 2001

	2000 Percent of *Projects*	**2001 Percent of *Projects***
Technical Assistance	74	71
Materials	67	69
Dollars	45	45
Equipment	29	33

Note:
For 2000, n=67 (58 projects and 9 centers)
For 2001, n=58 (47 projects and 11 centers)

Outcomes of Professional Development

Projects reported similar outcomes of professional development in both years. Categories of outcomes that emerged included course improvement, increased knowledge of technology, increased understanding of the particular industry, and networking opportunities. Please see Table 32, pages 42-43, for some examples from this year's survey.

STRENGTHS AND SUGGESTED IMPROVEMENTS

As previously noted, neither Congress nor NSF has specified what number of the ATE *projects* should be engaged in the four work categories. Nor have they stated the exact nature of work necessary to improve the workforce capabilities of technicians in our nation. Without such specifications, we have not addressed such issues. Instead, the primary findings for the work categories are largely descriptive and serve as a baseline

[9]Guskey, T. R. (1999). *Evaluating professional development*. Thousand Oaks, CA: Corwin Press.

and trends data for tracking the ATE program's progress. Thus, based on two years of survey data and our site visit findings, which largely validated our survey results, we are able to identify program strengths as well as two areas where we believe the ATE program could be improved:

Strengths

Projects report substantial work and activities in each of the identified areas (collaborations, materials development, program improvement, and professional development). These efforts can be viewed as significant strengths of the ATE program. Below we have identified five major points (bullets) that attest to these strengths.

- The *projects* were actively addressing the goals of the ATE program.

  Four general indicators of *project* health were used for this determination. On every indicator, the findings were positive in both years of the survey.

  1. *Projects* engaged in work that is consistent with the expectations of the ATE program as set forth in NSF guidelines and the general mandate of Congress. With the exception of two responding projects in 2001, every survey respondent in both years reported work in at least 1 of the 4 targeted work categories. In each year, more than 85 percent were engaged in at least 2 of 4 work categories.

  2. Eight general health questions addressed outcomes-based factors for three of the four categories of *project* work in both years (Note: Two questions addressing professional development outcomes were added in 2001, with positive findings). In both years, the results were positive on these eight factors–all responding *projects* were stable or increasing on the factors (see Tables 34-35, pages 45-46).

  3. When respondents were asked to describe significant unintended outcomes (positive and/or negative) of their *project's* work, most responses given in both years were positive in nature.

  4. The large majority of *projects* gathered data to better direct their efforts. In each year, more than 80 percent reported conducting needs assessments, and more than 80 percent reported employing evaluations to help guide their *projects* and/or ensure accountability of their efforts.

- ATE *projects* established a large number of collaborative arrangements with many types of organizations. The collaborations served multiple purposes and provided monetary support as well as other kinds of assistance for materials development, program improvement, and professional development efforts. These collaborations indicated substantial networking focusing on improving the number and quality of technicians in the nation's workforce.

- ATE *projects* developed many materials to support the preparation of technicians. These materials included modules (e.g., laboratory exercises) that can be incorporated into coursework and full courses and adaptations of courses.

- Projects and centers reported (a) improvement in their technician-based programs through constructing new courses, modifying existing courses, and taking steps to better serve students in matters of recruitment, retention, placement, and diversity and (b) a high proportion of students placed in technician positions and/or continuing their higher education.

- *Projects* conducted large numbers of professional development activities. Consistently,

    1. These activities were well attended.
    2. Participants expressed high levels of satisfaction with these activities.
    3. *Projects* provided materials, technical, and monetary support for participants.

Suggested Improvements

While the data suggest that *projects* conduct their work and achieve outcomes that are highly productive, there also are some areas where we believe the ATE program can be improved. We note two that have been persistent over both years and appear to be important to the long-term success of the ATE program.

1. *Projects* should conduct strong field tests of their products.
2. *Projects* should follow up professional development activities to assure implementation of ideas and materials at the local level and require local support as a requirement for participation in their professional development programs.

In part, these are matters of dissemination/implementation. In part, they appear to be tied to evaluation. For example, validation of developed materials is a strong evaluation matter. One also expects that *projects*, in their professional development efforts, will evaluate, collect data, and report findings that can show the extent of *project* follow-up

and local support for implementation. We encourage *projects* to more effectively employ evaluation to meet these project needs. [10]

We suggest taking three steps to address the issues identified here. First, review the *ATE Program Guidelines* to be published for the coming years and directly identify these issues as matters of importance to be addressed in *project* proposals. Second, alert the National Visiting Committees to look for and address these issues when they occur at the *project* level. Third, many of these issues appear to require common or at least comparable data collection practices across *projects*. *Projects* can be encouraged to collaborate, develop, and share ideas and materials that can effectively address these concerns.

[10] Our companion site visit findings confirm survey findings. These findings indicated that the methods employed for data collection for evaluative and accountability purposes (e.g., number of students enrolled, number of students completing or graduating, number of students that gained credit for articulated courses, follow-up on how professional development opportunities were implemented) were not as frequent or as useful as they could be in assisting the various ATE *projects*.

APPENDIX A

Survey Instrument and Methods

Survey Instrument and Methods

The purpose of the survey was to better understand the nature of the ATE *projects* and to begin to address the effectiveness of these grants. As in 2000, the survey was web based. Eighty-one (81) *projects* (70 projects and 11 centers) were asked to participate in the 2001 survey. These *projects* were selected to be included in the sample because they were active as of October 31, 2000 (i.e., currently in their grant-funding period), and had either a funding start date prior to March 1, 2000, or a funding renewal date on or after this date. The March 1 date was chosen as the cutoff date for new *projects* to ensure that *projects* in the sample had 12 months of data available when responding to the survey questions in February 2001.

The 2001 survey consisted of nine sections. As in the 2000 survey, six survey sections addressed the "work" categories, with "Program Improvement" divided into three parts to address three educational levels (secondary, associate, baccalaureate). Sections also were devoted to basic information (i.e., demographic information), monitoring, and status of the *project* (PI overview).

Only minor changes were made to the survey instrument used in 2000. Two items (items i. and j.) were added to the first question in the PI overview section to address professional development activities. Question seven in the three program improvement sections was divided into three questions to address interpretation problems. On the revised survey, question seven attended to the number of new, changed, and unchanged courses for the single program and location specified in question two, and question eight solicited information regarding the number of these same course types for this same program by course categories. Question nine asked for student enrollment and student success rates by course categories. Please see Appendix B, p. 61, for a complete copy of the survey. The web-based interface and related features were also updated to enhance user friendliness, and an on-line helpful hints (i.e., survey procedures, definitions) document was also made available.

After accessing the web site where they were presented with a copy of the survey, *project* PIs were asked to complete the required sections of basic information, monitoring, and the PI overview. The remaining six survey sections were optional and were to be completed only if they were relevant to a *project's* work. If sections were not relevant—for example, a *project* was not involved in materials development—*project* PIs were asked to deactivate the unneeded sections by designating the sections as not applicable. Data were gathered from February 20, 2001, through April 9, 2001.

Survey Sample and Process

On December 1, 2000, and January 10, 2001, we notified, via email, the *project* PIs of 70 projects and 11 centers that met our inclusion criteria (i.e., currently in their grant-funding period as of October 31, 2000, and had either a funding start date prior to March 1, 2000, or a funding renewal date on or after this date) regarding the

forthcoming survey. We asked them to verify their email addresses and check their browsers to ensure that they could access and complete the survey when the final form of the survey was released. Telephone calls were made to those not responding to these emails. On February 15, Dr. Teles of NSF emailed the PIs requesting their participation in the survey. On February 20, we contacted the *project* PIs via email and requested their assistance in providing data for the web-based survey. In this email, the purposes of the survey were described, and the web address for the survey, the user names, and passwords were provided to enable access to the survey. Reminder emails were sent on February 28, March 12, and March 26. On March 26, Dr. Teles also emailed *projects* that had not yet logged into the survey. Telephone calls were made to those not responding to these emails.

We originally planned to keep the survey available for six weeks. When we became aware that a NSF FastLane report was due March 31 for many of the *projects,* we extended the closing date of the survey from April 2 to April 9, 2001, and notified the *projects* of this action on March 30*.* At the close of the survey on April 9, 2001, 93 percent of the *projects* (75 *projects*–11 centers and 64 projects) completed all applicable and required sections, submitted them, and closed their surveys as requested. Because our response rate exceeded 75 percent, we concluded that our nonrespondent bias was low and that the findings were generalizable to active *projects* in the ATE program.

The data gathered from the 75 *projects* closing the survey are included in this report. Of the six remaining projects, two did not log into the survey, three logged in but did not provide any data, and one logged in and provided answers to only one question in one section. Therefore, these projects were excluded from the data set.

Data Analysis Steps and Cross-Checks

Nine numeric and nine text files were imported into SPSS and Excel, respectively. These files were saved in their original and in their converted formats. For the SPSS files, data dictionaries were created and applied to the converted formats. These files were then saved under new file names. Data verification steps included randomly selecting five surveys, printing them, and comparing them, item by item, to the import files, both numeric and text. Additionally, all data files were examined for outliers, and phone calls to *projects* were made when appropriate. To audit data analysis procedures, several tables in this report were randomly selected and then reviewed for accuracy by an individual who did not perform the original data analysis.

APPENDIX B

Survey 2001