Assessing the Impact and Effectiveness of the Advanced Technological Education (ATE) Program

2004 Survey Results

Volume III
Status of ATE Projects and Articulation Partnerships

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Executive Summary

The Advanced Technological Education (ATE) program is a federally funded program designed to educate technicians for the high-technology disciplines that drive the United States' economy. As stated in the ATE program guidelines,[1] this program

> . . . promotes improvement in technological education at the undergraduate and secondary school levels by supporting curriculum development; the preparation and professional development of college faculty and secondary school teachers; internships and field experiences for faculty, teachers, and students; and other activities.

ATE funds three program tracks: projects, centers, and articulation partnerships. This report, Volume III of the 2004 ATE Annual Survey Report, addresses findings from two of the three program tracks, projects and articulation partnerships. The report focuses on the following fundamental elements of the ATE program:

1. What is the size and scope of work for ATE projects?
2. To what degree do ATE projects apply rigorous internal practices in their operations?
3. How extensive are ATE project collaborations?
4. How productive are ATE projects in terms of the primary ATE work categories?
5. What impact are ATE projects having on students?

These questions are keyed to the primary evaluation indicators used to monitor the performance of ATE grantees. Additional questions, specifically, the relative contribution of ATE centers as compared with the ATE projects, are addressed in Volume I of this report and through other evaluation products.

The 2004 ATE Survey contained seven sections—three required and four supplementary. The three required survey sections were (1) grantee characteristics, (2) organizational practices, and (3) collaboration. Projects were invited to complete supplemental sections based on their program's efforts. These sections were directly aligned with the primary focus of ATE efforts: (1) materials development, (2) professional development, (3) program improvement, and (4) articulation agreements.

One hundred fifty-four ATE grantees responded to all or portions of the 2004 ATE Survey. Of these, 125 (81%) were ATE projects and 8 (5%) were ATE articulation partnerships; the remaining 21 (14%) were ATE centers. This large number of projects is reflective of the mix of ATE program awards, that is, a relatively large number of projects are funded in comparison to centers and articulation partnerships.

[1] Advanced Technological Education (2002). *Program Solicitation NSF-02-035*.

Size and Scope of the ATE Projects

The ATE projects and articulation partnerships are widely distributed across the United States. Most projects, 74 percent, were hosted by 2-year colleges. Projects predominantly engage in professional development for educators (81%), followed by materials development for national dissemination (68%), program improvement efforts (65%), and articulation between programs (54%). More than one-third of projects engaged in all 4 of these activities, while another one-fourth engaged in a combination of 3 (p. 6). These projects encompassed the complete range of ATE-specified technology fields. The predominant technological disciplines emphasized were IT/telecommunications, manufacturing and industrial technology, and "other" technological fields (which primarily emphasized teacher preparation).

Internal Practices

Seventy-six percent of projects report having at least one type of advisory committee, whether local, national, or regional; approximately $4,000 was spent annually on advisory committee activities per project (p. 9). More than two-thirds (70%) of projects have conducted assessments of workforce needs. Of these, one-fourth (25%) had conducted an assessment of workforce needs in the past 12 months, almost half (45%) reported that their workforce needs assessments had been conducted more than 12 months ago, and one-third (30%) of projects and articulation partnerships had never conducted a workforce needs assessment (p. 9). Ninety percent of respondents reported having an evaluator(s), either an external or internal evaluator, or both (p. 10). These projects spent slightly more than 3 percent of their total award for evaluation activities annually. A majority (98%) of projects reported engaging in at least 1 type of monitoring interaction with NSF (p. 11). Most (90%) indicated that they interacted with NSF through the annual PI meeting, and the majority (89%) also indicated e-mail contact with NSF.

Extent of Project Collaborations

Nearly all (89%) projects reported having at least 1 type of collaborative partnership, whether with other ATE grantees or non-ATE institutions (p. 13). A total of 3,248 collaborative partnerships were reported. Of these, 116 collaborative partnerships were reported with other ATE grantees and 3,132 were with non-ATE institutions (e.g., business and industry, other educational institutions, host institutions). Generally, each project collaborates with 3 other ATE grantees and 30 non-ATE partners (p. 13). Both ATE and non-ATE collaborations provided monetary and in-kind support to the ATE projects.

Collaborating institutions and organizations provided slightly more than $9.5 million in external support, $4.3 million in monetary support, and $5.2 million in-kind (p. 15). In comparison, these projects received a total of $67.9 million in NSF funding. A small relationship (r = .294, p = .01) between external support (monetary and in-kind) and award amount was found (p. 16), suggesting that projects with larger NSF awards were more successful in leveraging external support. Other education institutions provided the bulk of both monetary (54%) and in-kind (57%) support to ATE projects. In addition

to monetary and in-kind support, projects most frequently reported that collaborative purposes were for general support, whether with other ATE grantees or non-ATE institutions.

Project Productivity in ATE Work Categories

Taken as a whole the ATE projects are producing large quantities of materials, providing professional development opportunities for educators, developing programs across numerous locations and education levels, serving students, and providing students pathways to higher level technician education. For each category one to two project are outliers, providing a large proportion of the impact.

- Sixty-eight percent of respondents reported developing materials in the past 12 months. These materials consisted of 2,306 courses, modules, and other materials (p. 17). Of these, almost half (48%) were developed by 2 projects, which produced a total of 1,102 materials (primarily modules—print, online, and audio/video). Setting the 2 major producers aside, the average project produced about 12 material items in the past year. Our primary indicator of materials productivity—number of materials disseminated—saw similar trends; of materials distributed, a single project accounted for 16,000 (57%) of the total of 27,893 (p. 18). Excluding the single highly productive project, the average project disseminated an average of 134 materials.

- Eighty-one percent of respondents reported engaging in professional development activities. Of the 12,128 project professional development participants who attended 2,017 project-sponsored events (p. 21), 1,870 participants were the result of 2 projects (720 and 1,150 respectively). These 2 projects reached 15 percent of the total professional development participants with only 7 combined events (p. 22). Setting those 2 projects aside yields an average project per year professional development participant rate of 83 persons.

- Sixty-five percent of projects reported program improvement efforts. Almost half (48%) of projects focused their program improvement efforts exclusively at the associate level (p. 26). Respondents reported offering 273 ATE-funded programs, consisting of 905 courses across 549 locations (p. 27). A single project accounted for 12 percent of these programs, courses, and locations combined. Setting that 1 project aside, the typical (average) project profile consists of approximately 2 programs, 8 courses, and 5 locations. Our primary indicator of program improvement productivity, number of unique students taking at least 1 ATE-program course in the past 12 months, returned similar results; 3 projects accounted for 9,537 (47%) of the 20,080 students who have taken at least 1 course in the past 12 months (p. 28). The average project reached 127 students per project.

- Articulation activities occurred both in projects funded specifically to serve articulation (i.e., articulation partnerships) and projects that engaged in articulation efforts among other foci. Of the 54 percent of projects responding, the large majority (66) were regular projects with only 6 having received funding as articulation partnerships (p. 29).

Combined, these projects reported a total of 295 articulation agreements across 517 institutions, which served matriculation needs for 1,001 students in the past 12 months (p. 30). Most agreements (57%) were between high schools and 2-year colleges, while one-third (31%) were between 2- and 4-year colleges and 1 in 10 (11%) were for purposes of teacher preparation–high schools to 2-year colleges. Each type of agreement served approximately 300 students (p. 30). Five projects accounted for 410 (41%) of the articulating students. Of the 5, one was an ATE articulation partnership (p. 31).

Three aspects suggest that articulation partnerships approach articulation differently and more productively than projects generally:

- *Articulation partnerships create fewer agreements*. On average, projects reported engaging in seven articulation agreements, while articulation partnerships reported an average of one (p. 30).

- *Articulation partnerships partner with more institutions per agreement.* Of these agreements, *projects* reported partnering with an average of 13 other institutions. Articulation partnership projects reported an average of 21 partnerships with other institutions, almost twice the number reported by projects (p. 30).

- *On average, each articulation partnership project is 3 times more productive than its project counterpart.* The average project assisted 26 students in matriculating to higher level technological education programs in the past 12 months, while each articulation partnership project served an average of 83 students (p. 30).

- Regardless of how many categories of work a project engages in, high productivity is likely limited to just one. However, a project's attention to multiple categories, up to three, appears not to be a factor in project productivity. Among those projects reporting work in all four categories, only a small percentage (10%) had greater than average productivity in any category (p. 8).

Student Impact

Eighty-six projects (65%) reported on student enrollment questions. Their responses indicate that more than 20,000 students participated (took at least 1 course) in their programs during the past year (p. 34). Both application/enrollment and retention data indicate strong student interest in the program. During the year more than 9,661 students applied to these programs, and 8,152 new students were enrolled across all education levels (p. 35). Overall, the number of students completing project programs exceeds those who fail to complete (drop out) by an almost 3:1 ratio (p. 36). Program participation was greatest for associate degree students (46%), quite large for secondary students (35%), but included much smaller numbers of on-the-job (14%) and baccalaureate students (5%). Of these students, 1 in 10 was employed as a technician prior to enrollment (p. 37).

Three additional factors are key program indicators:

- The program serves as an education beginning point, rather than an end point. Upon program completion nearly all students (94%) started or continued STEM education (p. 37). Even for those who left the program prior to completion, more than half (57%) started or continued STEM education (p. 37).
- Immediate impact on the technician workforce is visible in two ways. More than a quarter of program completers (28%) started or continued employment as technicians (p. 37). Also, among those who left the program prior to completion, a third (33%) started or continued technician employment (p. 37).
- Participation by women and minority groups remains lower than desired. Approximately a third of the students fit into each of these groups. Thirty-two percent of ATE-program students are female and 31 percent are minority (pp. 39-40).

Overall Assessment

The introduction to this report identified five key questions or issues to be addressed. The ensuing sections reported on each of the five points. Here we provide general judgments across those five points. As reported more specifically below, we judge the program's projects'-based performance to be sound. We've judged two indicators to be fully positive, two as positive but with one or more caveats attached, and one as partially positive.

The first point produced a split judgment. The ATE program guidelines call for 2-year institutions to take the lead in ATE projects. This expectation is met; 74 percent are hosted by 2-year institutions. The guidelines also state that "projects should narrowly focus on one or more of these activities [primary work categories]." That guideline is not well met; nearly two-thirds of the projects have broad scopes, where we defined broad to be at least three of the four work categories. However, even among projects with large scopes, substantial productivity is almost always limited to a single area.

The second point is positive, but includes two general worries. ATE guidelines include a number of factors that together address issues of project management. Our findings indicated that projects generally meet these expectations for project management. These expectations include interactions with NSF program staff, needs assessments, and evaluative efforts. However, the fact that nearly a third did not base their work on needs assessment seems larger than desirable. A second point of concern is that projects on average spent 3 percent of their budgets on evaluation. That figure is well below the recommended amount of 5 to 10 percent of project budget (*EHR/NSF Evaluation Handbook*). This suggests that although project management efforts are in place, at least by two indicators, less attention/support is given to them than NSF deems optimal.

The third point is uniformly positive. Project collaborative efforts are extensive. While the survey data do not provide indicators of quality, 3 facts combine to suggest that this is a

program strength. First, nearly all projects collaborate with other organizations and institutions. Second, monetarily, collaborators add approximately 14 percent to the overall ATE project budgets for the year. Third, the typical project reaches out to a very large number of collaborators (approximately 30 non-ATE funded institutions or organizations) to achieve project objectives. These factors of involvement, added support, and reach provide a substantial basis for strengthening the productivity of the ATE program.

The fourth point, project productivity, yielded uniformly positive indicators. The projects produce large numbers of materials, engage large numbers of teachers in professional development, produce changed (improved) programs and courses in many locations, and provide articulation arrangements to facilitate large numbers of student matriculations across academic levels.

The fifth point, regarding student impact, shows that projects do reach large numbers of students to provide technician education courses and programs. These programs appear to stimulate further STEM-based study. While most students continue their educations rather than immediately beginning or continuing work as technicians, large numbers do work as technicians. Impressive as these numbers are, the two figures related to gender and ethnicity indicate that the program is not doing better now than in previous years in its attempts to bring technician education to these two important groups.

Recommendations

In large measure the ATE program's efforts related to projects appear to be on target. This suggests that the program should continue its current course. The suggestions below should be treated as items to explore rather than as mandates for change.

1. *Encourage the ATE projects to narrow their focus of work activities*. Approximately a third of the projects attempt to address all four categories of project work: materials development, professional development, program development, and articulation partnerships. That number is quite high given the program expectation that projects have a narrow focus. The lower level of success among the projects supports narrowing the focus a bit. We encourage limiting projects to three areas of emphasis at most, with clear priority given to one. Our findings suggest that strong success is usually in one area, and the added impetus may help projects plan better for success.

2. *More strongly encourage the ATE projects to conduct assessments of workforce needs*. One way to do this is to include needs assessments as part of evaluation expectations for projects. Including such needs assessments certainly can be accommodated without stressing the evaluation budgets of the projects (at least not beyond recommended NSF bounds). These assessments likely will strengthen the projects and the program as a whole, since timely knowledge of the local, regional, and national workforce needs will guide and inform project efforts across all program-related activity areas (e.g., materials development, program improvement).

3. *Encourage studies of recruitment and retention of female and minority students*. In this and previous reports we have consistently noted the difficulties in meeting the challenges of gender and ethnicity recruitment. This continues to be an area of program underachievement. We are not sure what additional steps should be taken. We encourage study (research) of this problem. Perhaps this is an area where collaborative relationships, an area of program strength, can be employed in conjunction with this focus to improve results.

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The Status of ATE Projects and Articulation Partnerships

This report presents results from the fifth annual survey[2] of Advanced Technological Education (ATE) projects, centers, and articulation partnerships, collectively *projects*. This survey is part of larger effort to evaluate the ATE program. When combined with other information[3] and criteria, these findings provide a basis for judging the overall impact and effectiveness of the ATE program. Findings from this survey are expected to be useful to NSF staff in preparing their annual reports to Congress and for making programmatic decisions. Recipients of ATE grants are likely to use survey results to learn about the activities and findings of other grantees and to serve their own improvement needs.

ATE has approximately 220 active awards. Of these, 163 ATE-funded projects, centers, and articulation partnerships were asked to participate in the 2004 survey.[4] During the survey administration period, five *awards* were removed from the sample, resulting in a final target sample of 158 grantees. Of these, 154 (97%) responded to all or portions of the survey.

The ATE program's grantees are expected to develop materials, improve instructional programs, provide professional development to STEM faculty, and establish articulation agreements that enable students to further their education. Grantees are expected to collaborate with business, industry, one another, and other educational institutions. These efforts are directed primarily at the associate degree level through two-year and technical colleges, but they also impact the secondary and baccalaureate education levels.

In an effort to provide targeted information for various audiences, we have broken this report into three volumes. Volume I examines four important program design characteristics and provides evaluative judgments about the program. Volume II reports the status of ATE centers with regard to their efforts in each work category. Volume III does the same for the combined set of projects and articulation partnerships.

In addition to this report, summarized survey data are available through interactive data displays that can be accessed at www.ate.wmich.edu/sv/home.

[2] The first ATE survey was conducted in May 2000. Subsequent surveys were conducted in February of 2001, 2002, 2003, and 2004.
[3] All reports and products from the ATE program evaluation can be accessed at www.ate.wmich.edu.
[4] For a description of the sample selection criteria and survey structure, refer to the notes at the end of this report.

This report addresses the status of ATE projects and articulation partnerships. ATE program guidelines[5] state that ATE projects should focus narrowly on one or more of the following five activities: curriculum and materials development for national dissemination, program improvement, professional development for educators, technical experiences, and laboratory development; yet, ATE encourages projects to cut across the range of these activities.

In reporting survey results for ATE projects, several questions guided our work.

1. What are the size and scope of work for ATE projects?
2. To what degree do ATE projects apply rigorous internal practices in their operations?
3. How extensive are ATE project collaborations?
4. How productive are ATE projects in terms of the primary ATE work categories?
5. What impact are ATE projects having on students?

These questions are keyed to the primary evaluation indicators used to monitor the performance of ATE grantees. Additional questions, specifically the relative contribution of ATE centers as compared with the ATE projects, are addressed in Volume I of this report and through other evaluation projects.

[5] The 2002 program solicitation [Advanced Technological Education (2002). *Program Solicitation NSF-02-035*] provides the frame of reference for this report, because the first time grants awarded under this solicitation were invited to participate in the annual survey was 2004 due to the sample selection criteria described in the notes to this report.

Project Size and Scope

In 2004, 125 ATE projects and 8 ATE articulation partnerships responded to the annual survey, representing 86 percent of the total survey responses combined. Consistent with the ATE program guidelines, 74 percent were hosted by 2-year colleges; 22 (17%) reported being hosted by 4-year colleges, 5 (4%) were hosted by associations/societies, 1 (1%) was hosted by a secondary school, and 7 (5%) reported being hosted by some "other" institution type. Due to the small number of ATE articulation partnerships that responded to the 2004 ATE Survey, this report aggregates these findings and reports on both projects and articulation partnerships simultaneously. Where applicable, these data are disaggregated.

As illustrated in Figure 1, the ATE projects and articulation partnerships are distributed widely across the United States.

Note. Projects are indicated by blue circles and articulation partnerships are indicated by red triangles.
Note. *N* = 133.

Figure 1: Geographic Distribution of ATE Projects and Articulation Partnerships

Longevity is the difference between the start date of the 2004 ATE Survey and the start date of the respondent's current award. The largest proportion of projects sampled indicated being between 1 to 3 years of age (81%), as would be anticipated from ATE's 3-year funding cycle for projects. As Table 1 shows, longer periods (3 or more years) were reported by 20 (15%) projects. Older projects (3+ years) were recipients of 1 or more antecedent awards to continue their work or similar work.

Table 1: Project Longevity

Age in Years	*N*	*%*
1	5	4%
1-2	46	35%
2-3	62	47%
3-4	17	13%
4 or more	3	2%

Note. *N* = 133.

Most ATE projects receive awards between $500,000 and $849,999, while articulation partnerships generally receive between $300,000 and $499,999 (see Table 2). The average award given to an ATE project (*M* = $532,411) is nearly 2 times greater than for an ATE articulation partnership (*M* = $302,616)—see Table 3. Individual projects and articulation partnerships receive much less funding per grant than do centers. However, the current total support given to ATE projects (including ATE articulation partnerships) is nearly double that for ATE centers with $68,972,322 (*N* = 133) versus $36,345,113 (*N* = 21) respectively (c.f., Volume II).

Table 2: Numbers of Projects and Articulation Agreements Funded by Award Amount

Award Amount	Project *N*	Articulation Partnership *N*	Total *N*
$0-$299,999	31	3	34
$300,000-$499,999	34	5	39
$500,000-$849,999	47	0	47
$850,000 +	13	0	13
Total	125	8	133

Table 3: Summary Funding Statistics for Projects and Articulation Agreements

Project Type	*M*	*SD*	Total
Project	$532,411	$309,266	$66,551,397
Articulation Partnership	$302,616	$24,688	$2,420,925
Total			$68,972,322

Note. *N* = 133.

The ATE projects focused on a wide array of disciplinary coverage. Of the 20 categories of technological emphases established by ATE,[6] the 133 projects and articulation partnerships indicated activity in 19. As illustrated in Table 3, the top 3 disciplinary foci, in ascending order, were information technology and telecommunications (11%), manufacturing and industrial technology (13%), and "other" fields (23%). Four (3%) projects failed to report their technological emphases. Numbers in parentheses represent articulation partnerships.

Table 4: Projects' Technology Emphases[7]

Technological Fields	***N***	**%**
Agriculture	3	2%
Aquaculture	1	1%
Biotechnology	7	5%
Chemical Technology	4	3%
Electronics, Instrumentation, Laser & Fiber Optics	3	2%
Engineering Technology (General)	10 (1)	8%
Environmental Technology	5	4%
Geographic Information Systems	2	2%
Graphics & Multimedia Technology	2 (1)	2%
Information Technology, Telecommunications	14	11%
Machine Tool Technology, Metrology	1	1%
Manufacturing & Industrial Technology	17	13%
Mathematics	8	6%
Multidisciplinary or Interdisciplinary (General)	12 (2)	9%
Physics	5	4%
Semiconductor Manufacturing	4 (1)	3%
Transportation	1	1%
Other	30 (3)	23%

Note. *N* = 133.

Other fields described by respondents, which predominately focused on teacher preparation, are shown in Figure 2.

✓ Teacher preparation (indicated by 6 projects) ✓ Creation and dissemination of resource materials for secondary and community college teachers ✓ Math and chemistry for middle school teachers	✓ Geospatial technologies ✓ Pharmaceutical manufacturing ✓ Student recruitment ✓ Distance education- woodworking college Internet course

Figure 2: Other Technologies Emphasized by ATE Projects

[6] Advanced Technological Education (2002). *Program Solicitation NSF-02-035*.
[7] ATE articulation partnerships are indicated in parentheses.

The ATE projects reported engaging in a variety of programmatic activities (see Table 5) related to their primary technological emphases (articulation partnerships are indicated in parentheses). Ninety-three (76%) respondents indicated engaging in professional development activities and 75 (60%) reported program improvement activities. A smaller proportion (54%) indicated involvement in developing materials for national dissemination. An even smaller number indicated articulation agreements (34%), just 5 of the 8 ATE articulation partnerships (63%) who responded to the survey reported on their activity in this area—though the other 3 did report on activity in other program areas.

Table 5: Project Engagement in Programmatic Activities and Work Categories[8]

Programmatic Activities	***N***	**%**
Materials Development for National Dissemination	72 (2)	54%
Professional Development	101 (8)	76%
Program Improvement	80 (5)	60%
Technical Experiences (Internships, Summer Camps, etc.)	52 (3)	39%
Laboratory Development	30 (1)	23%
Research	15 (1)	11%
Articulation Agreements	45 (5)	34%
Other	16 (2)	12%
Work Category Reported in Survey Section	***N***	**%**
Materials Development	90 (3)	68%
Professional Development	108 (7)	81%
Program Improvement	86 (5)	65%
Articulation Agreements	72 (6)	54%

Note. *N* = 133.

These data support the ATE projects' engagement in the complete range of ATE activities. Although the projects are more heavily engaged in the primary categories of work (i.e., materials development, professional development, program improvement, and to a lesser extent articulation agreements), they also engage in a wide range of secondary activities such as laboratory development and technical experiences.

Respondents were asked to complete supplementary sections of the survey to elaborate on their projects' primary work activities. Figure 3 shows the descriptions that projects used as a basis for completing supplementary sections.

[8] ATE articulation partnerships are indicated in parentheses.

Materials Development activities result in textbooks, laboratory experiments and manuals, software, CD-ROMs, videos, or other courseware that will be published for national distribution to colleges, secondary schools, or industry.

Professional Development provides current secondary teachers and college faculty with opportunities for continued professional growth in areas that directly impact advanced technological education.

Program Improvement activities enhance a curriculum in multiple ways, producing a coherent sequence of classes, laboratories, and work-based educational experiences that revitalize the learning environment, course content, and experience of instruction for students preparing to be science and engineering technicians. The improved program leads students to an appropriate degree, certification, or occupational competency point and provides industry with a larger pool of skilled technicians.

Articulation Agreements are specific agreements that allow students who complete an education program or series of courses to matriculate to a higher level of education at specified institutions. This addresses both articulation agreements for students preparing for careers as technicians as well as teacher preparation agreements.

Figure 3: ATE Program Work Categories

As indicated by the completion of one or more of the nonrequired survey sections, the ATE projects reported various degrees of engagement in the primary categories of work (see Table 6). Projects provided supplementary data (nonrequired survey sections) to a greater extent than they had indicated in the grantee characteristics section (see Table 5). For example, although only 70 projects indicated engaging in development of materials for national dissemination in the description of their program, 87 projects completed this supplementary section of the survey. These discrepancies occurred across all of the major work categories.

Individually and collectively, the ATE projects reported engaging in the expected ATE work categories (see Table 6). Overall, 128 projects responded to 1 or more of the nonrequired survey sections. Of these 44 (34%) engaged in all 4 activities, 33 (26%) engaged in a combination of 3 activities, and the remaining 56 (42%) engaged in 2 or fewer. This high proportion of projects that report engaging in 3 or 4 major work activities runs contrary to ATE program guidelines (NSF-02-035), which encourage projects to “focus narrowly on one or more of these activities."

Table 6: Project Engagement in Combinations of Work

Combinations of Work	***N* and %**
All 4 activities	44
% of total	33%
3 of 4 activities	33
% of total	25%
2 of 4 activities	31
% of total	23%
1 of 4 activities	19
% of total	14%
0 of 4 activities	6
% of total	5%

Note. *N* = 133.

As illustrated in Table 7, regardless of how many categories of work a project engages in, high productivity is likely limited to just one. However, a project's attention to multiple categories, up to three, appears not to be a factor in project productivity. Among those projects reporting work in all four categories, only a small percentage (11%) had greater than average productivity in any category.

Table 7: Level of Success by Number of Work Activities

	% Above Average in 1 Category	**% Above Average in 2 Categories**	**% Above Average in 3 Categories**	**% Above Average in 4 Categories**	
1 Category (*N* = 19)	53% (10)	47% (9) not successful			
2 Categories (*N* = 31)	45% (14)	3% (1)	52% (16) not successful in any combination		
3 Categories (*N* = 33)	45% (15)	12% (4)	3% (1)	39% (13) not successful in any combination	
4 Categories (*N* = 44)	9% (4)	2% (1)	0% (0)	0% (0)	89% (39) not successful in any combination

Note. Based upon the primary indicators for each type of work: Materials Development = number of materials disseminated; Professional Development = number of professional development participants; Program Improvement = number of unique students who have taken at least 1 course in the past 12 months; and Articulation Agreements = number of students that articulated in past 12 months.

Note. Includes outlying cases (i.e., highly productive projects).

Internal Practices

We used four indicators to gain insight into the internal operations of ATE projects. These indicators focus on the information and processes centers employ to guide their work including use of advisory committees, conducting workforce needs assessments, evaluation, and monitoring—i.e., communication with NSF. Ninety-five percent of the projects engaged in at least one these four activities, and more than 80 percent engaged in at least three of the four.

The first indicator, use of advisory committees, was chosen because NSF encourages their use, especially for large projects. These advisory committees may be national committees, regional committees, local committees, or others specified by the ATE project. One hundred (76%) ATE projects indicated having at least 1 type of advisory committee. Fifty-three (53%) of these reported the use of local committees, 40 (40%) employed national committees, 22 (22%) had regional committees, and 9 (9%) used other types of committees. Thirty-one (24%) projects and articulation partnerships indicated that they had no advisory committee. Forty-four percent of responding projects reported receipt of a written report from their advisory committee(s) in the past 12 months.

Respondents strongly agree (M = 4.5, SD = 0.7) that advice received from their advisory committees has been useful.[9] The utility of that information is balanced against an overall cost of $275,676 projects paid for these advisory committees in the past 12 months. This is slightly less than $4,000 per project ($M$ = $3,938.2, SD = $5,454.5).

Representative statements from ATE projects describing strengths and limitations associated with their advisory committees are illustrated in Figure 4.

Strengths	Weaknesses
✓ Committee is composed of nationally known figures in E-Business and online education	✓ Committee availability
✓ Advice, ideas, and direction	✓ Frequency of committee meetings (e.g., "The NVC meets only once per year")
✓ Contemporary inputs, current job skills needs, and knowledge of the field	✓ Responsive rather than proactive
✓ Plans for outreach to women and minorities	✓ Conflicting advice or difficulty in implementing advice

Figure 4: Strengths and Weaknesses of Project Advisory Committees

Needs assessments, our second indicator of rigor, are viewed as important, even crucial tools for planning and guiding work. Of the 130 responding projects and articulation partnerships, 70 percent indicated having conducted an assessment of workforce needs. Of these, one-fourth (25%) had conducted an assessment of workforce needs in the past 12 months and almost half (45%) reported that their workforce needs assessments had been conducted more than 12 months ago. These responses also indicated that 30 percent of projects and articulation partnerships had never conducted a workforce needs assessment.

[9] From 1 = strongly disagree to 5 = strongly agree.

Moreover, projects and articulation partnerships were asked to describe how workforce needs assessments were conducted, what they learned, and how the information from these assessments was used. Eighty-two projects provided information about the implementation, outcomes, and uses of workforce needs assessments. Figure 5 summarizes these responses.

How Were Workforce Needs Assessments conducted?	**What Was Learned?**	**How Were They Used?**
✓ National forums, advisory boards, councils ✓ Surveys, focus groups, studies, benchmarking, external scans, DACUM ✓ Reviews of the Bureau of Labor Statistics ✓ Anecdotal information from the field ✓ Pre- and postassessments of needs ✓ Workforce needs assessment	✓ Needs for specific professionals (e.g., teachers) and specific programs (e.g., E-business) ✓ Identification of main areas of need as priorities to be addressed (e.g., transferable skills, more content training, analytical and statistical skills, understanding of sustainability practices) ✓ Skill sets have changed since the ATE grant was funded ✓ Big gaps between school offerings and industry needs	✓ Program/curriculum development/improvement ✓ Interdisciplinarity of learning modules ✓ Integration of more scientific activities and data analysis ✓ Focus on broader aspects of proposals ✓ Incorporation of technology-based curricular materials ✓ Preparation of faculty in effective teaching practices/ teacher training ✓ Development of work-related technical experiences for faculty and students ✓ Better planning ✓ Plans for future workshops/ courses ✓ Competency lists for various jobs in the apparel industry ✓ Standards of Excellence

Figure 5: Needs Assessments: Implementation, Outcomes, and Utilization

Evaluation was the third indicator of project rigor. The ATE program mandates evaluations for projects it funds, and the EHR directorate encourages expenditure of 5 to 10 percent of each project's budget on evaluation (*User Friendly Handbook for Project Evaluation: Science, Mathematics, Engineering, and Technology Education*, 1993). These evaluations are intended to serve the ATE projects in a number of ways, for example, program documentation, monitoring, or for purposes of program improvement. The evaluations may be conducted internally, externally, or in both forms.

One hundred twenty-nine projects reported whether or not they had an evaluator. Of these, 90 percent (116) do utilize an evaluator(s) and 10 percent (13) do not. Of those projects that have an evaluator, 79 percent reported having an external evaluator, 12 percent had both an internal and an external evaluator, and 9 percent employed an internal evaluator exclusively. In addition, 95 (82%) of these projects and articulation partnerships reported that they had received a written report from their evaluator(s) in the past 12 months.

The projects and articulation partnerships respondents were asked to address both cost and usefulness of evaluations. They indicated spending slightly more than 3 percent of their total ATE awards on evaluation in the past 12 months (*M* = $7,175.3, *SD* = $6,754.6). They also reported that evaluation was essential to their work (*M* = 4.3, *SD* = 0.7, *N* = 117) and that these evaluations provided evidence of their outcomes (*M* = 4.4, *SD* = 0.7, *N* = 116). Figure 6 provides representative evaluative statements from these respondents summarizing points pertinent to evaluation use.

Strengths	Weaknesses
✓ Experience and expertise	✓ Bias of internal evaluation
✓ Content knowledge	✓ Time and costs
✓ Objectivity	✓ Difficulty in implementing recommendations
✓ Research design and methodology	✓ Emphasis on details rather than broader picture
✓ Statistical "know-how"	✓ Distance

Figure 6: Strengths and Weaknesses of Project Evaluation

Projects also have opportunities to engage in other activities that reinforce their relationship with NSF, receive guidance and feedback on their activities, and improve collaborations with other projects and centers. Overall, these activities include site visits by NSF and to NSF, telephone calls from/to NSF, e-mail contacts, principal investigator meetings, NSF reactions to written reports, and NSF recommendations for project improvement. The activities are collectively referred to as monitoring, the fourth indicator of project rigor.

Projects interact with NSF in a variety of ways (see Table 8). One hundred thirty of 132 (98%) indicated engaging in at least 1 of these activities. The large majority engaged in multiple ways. Four projects (3%) indicated participation in all of these activities, 32 (24%) indicated engagement in 5 or 6, 54 (41%) reported involvement in 3 or 4, and 40 (30%) participated in only 1 or 2.

Table 8: Project Interactions with NSF

Interaction Types	*N*	%
Site Visits by NSF	17	13%
Site Visits by Center to NSF	32	24%
Telephone Calls to/from NSF	81	61%
E-Mail Contacts with NSF	118	89%
Attendance at Principal Investigator Meetings	119	90%
NSF Reading and Reaction to Written Reports	48	36%
NSF Recommendations for Improving Center Work	38	29%

Note. *N* = 132.

As Table 8 shows, the majority (90%) of projects and articulation partnerships reported at least attending the annual Principal Investigators meeting. These respondents also corresponded with NSF via e-mail and telephone. More than one-third (36%) of

respondents indicated that NSF read and reacted to their written reports; fewer received recommendations from NSF staff for improving their project's work (29%).

The ATE projects view NSF staff positively. When asked about their perceptions of NSF, respondents agreed[10] that NSF is responsive in meeting their needs, that evaluative actions by NSF improved the quality of their work, that NSF facilitated collaboration with other ATE awards, and that NSF accurately understands the ATE projects and articulation partnerships (see Table 9).

Table 9: Project Perceptions of NSF[11]

Perceptions	***N***	***M***	***SD***
NSF is Responsive in Meeting Center Needs	131	4.4	0.7
NSF Evaluative Action has Improved the Quality of Our Work	129	3.8	0.9
NSF Facilitates Collaboration with Other ATE Awards	131	4.1	0.8
NSF has Accurate Understanding of Center	131	4.2	0.7

Note. *N* = 132.

[10] From 1 = strongly disagree to 5 = strongly agree.
[11] From 1 = strongly disagree to 5 = strongly agree.

Extent of Project Collaborations

To promote improvement in technological education, the ATE program encourages the development of collaborative activities in all types of *projects*. Projects completed this section of the 2004 ATE Survey if they had collaborated with other ATE *projects* or with non-ATE institutions. The operational definition of collaboration established for the survey follows:

> An ongoing relationship with another institution, business, or group that provides money and/or other support to your project, center or partnership. Collaborators may include local businesses, other educational institutions, public agencies, industry groups, other ATE projects, centers, partnerships, and the host institution.

One hundred thirty-one projects (98%) responded to this portion of the survey and reported collaborative activities with other ATE *projects* and with non-ATE institutions.

Collaborations with ATE projects. Slightly more than one-third (35%) of responding projects reported collaborating with other ATE projects, for a total of 116 collaborative arrangements (fewer than 3 per responding project). Nine (7%) of these projects were supported monetarily by 12 collaborative partners, and 20 (15%) received in-kind support from 63 collaborators (see Table 10).

Table 10: Number of Project Collaborations with Other ATE Projects

	Total	*M*	*SD*	*N*	%
Number of Collaborations	116	2.5	3.5	46	35%
Number Providing Monetary Support	12	1.3	0.7	9	7%
Number Providing In-Kind Support	63	3.2	5.0	20	15%

Note. *N* = 131.

These collaborations served multiple purposes. Of the 50 responses addressing collaborative agreements with other ATE-funded projects, the most frequently cited were for general support (30%); materials and professional development (22% each); and program improvement (16%). Only 2 projects (4%) indicated articulation agreements as the purpose for the collaboration, and 1 of these was an ATE articulation partnership.

Non-ATE collaborations. Projects are also expected to collaborate with non-ATE institutions. Nearly all of the ATE projects and articulation partnerships indicated collaborating with at least one non-ATE-funded institution.

Respondents reported more than 3,000 collaborations in total. As Table 11 illustrates, the majority of these collaborative arrangements were with business and industry (1,488) and other education institutions (1,032). These figures suggest that each project engages in approximately 30 collaborative relationships.

Collaborators typically provided in-kind or monetary support for project efforts with the large majority (approximately 90%) providing in-kind support. For both categories of support, Table 11 shows that “other education institutions” participated in the greatest numbers. The Total column of Table 11 shows that other education institutions participated in the majority of collaborations yielding both monetary (56%) and in-kind (59%) support, although the total number of collaborative partnerships with business and industry is greater.

Table 11: Number of Project Collaborations with Non-ATE Institutions

Collaborator	Purpose	Total	*M*	*SD*	*N*	%
Business/ Industry	Number of Collaborations	1,488	15.8	54.8	94	72%
	Number Providing Monetary Support	86	3.7	3.2	23	18%
	Number Providing In-Kind Support	755	10.3	24.0	73	56%
Host Institution	Number of Collaborations	344	3.4	4.9	100	76%
	Number Providing Monetary Support	60	1.6	1.2	38	29%
	Number Providing In-Kind Support	204	3.0	5.3	68	52%
Other Education Institutions	Number of Collaborations	1,032	8.9	12.3	116	89%
	Number Providing Monetary Support	221	10.5	26.3	21	16%
	Number Providing In-Kind Support	1,569	23.4	122.4	67	51%
Public Agencies	Number of Collaborations	160	3.6	4.0	45	34%
	Number Providing Monetary Support	16	1.8	1.3	9	7%
	Number Providing In-Kind Support	99	3.5	4.0	28	21%
Other Organizations	Number of Collaborations	108	2.8	2.6	38	29%
	Number Providing Monetary Support	11	1.6	1.1	7	5%
	Number Providing In-Kind Support	45	2.7	2.6	17	13%

Note. *N* = 131.

These non-ATE collaborative relationships served a number of program-related purposes as displayed in Table 12. Overall, respondents most frequently stated these arrangements were for general support. Articulation agreements were reported most often by projects collaborating with other education institutions (30%), and professional development was indicated as the purpose for collaborating with other organizations (23%). The most diverse purposes were served by collaborations with business and industry, projects' host institutions, and other education institutions. These were frequently for development of materials, professional development, and program improvement as well as general support. Only one responding ATE articulation partnership indicated articulation agreements as the purpose for collaborating with a non-ATE institution.

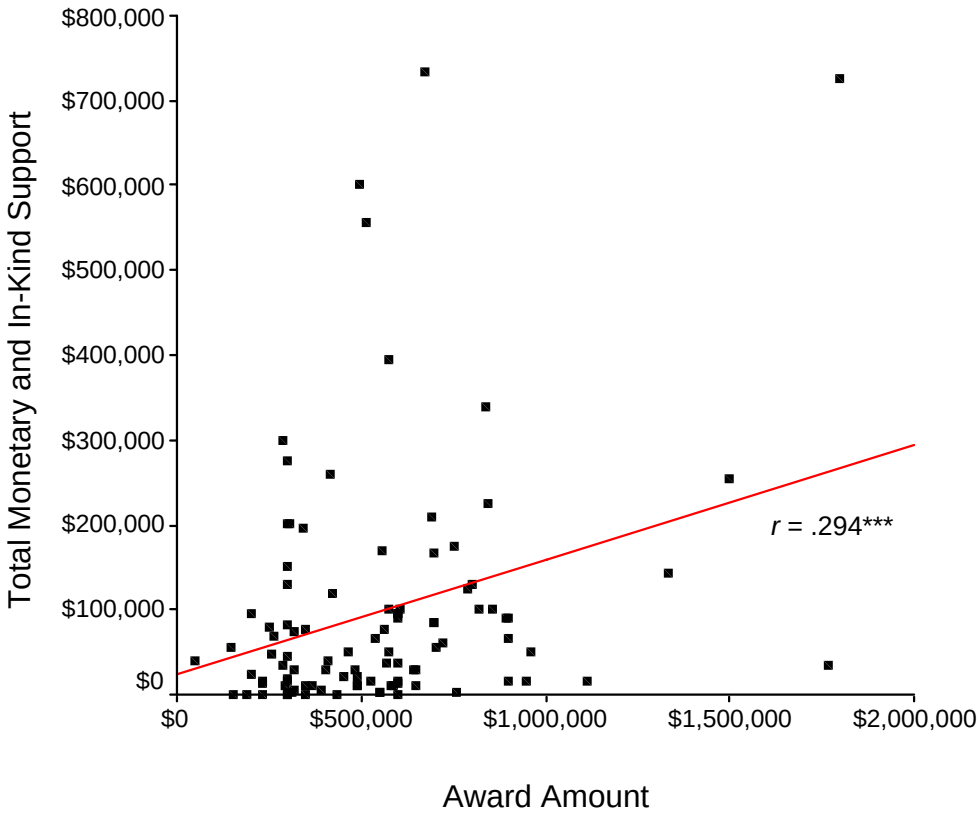
Table 12: Purposes of Project Non-ATE Collaboration

Collaborator	Purpose	*N*	%
Business/Industry	General Support	39	40%
	Materials Development	20	21%
	Professional Development	16	16%
	Program Improvement	17	18%
	Other	5	5%
Host Institution	General Support	70	63%
	Materials Development	10	9%
	Professional Development	10	9%
	Program Improvement	17	15%
	Articulation Agreements	4	4%
Other Education Institutions	General Support	31	27%
	Materials Development	18	16%
	Professional Development	16	14%
	Program Improvement	10	9%
	Articulation Agreements	35	30%
	Other	5	4%
Public Agencies	General Support	28	58%
	Materials Development	2	4%
	Professional Development	5	10%
	Program Improvement	8	17%
	Articulation Agreements	2	4%
	Other	3	6%
Other Organizations	General Support	24	62%
	Materials Development	1	3%
	Professional Development	9	23%
	Program Improvement	4	10%
	Other	1	3%

Note. *N* = 131.

Sixty respondents reported receiving $4,353,838 in monetary support (*M* = $72,564; *SD* = $108,254.5) and 93 reported receiving in-kind assistance valued at a total of $5,250,772 (*M* = $56,460; *SD* = $97,205.3). Combined the total monetary and in-kind assistance from collaborative partnerships was valued at more than $9,600,000. Four projects account for 27 percent of this total, and a single respondent reported receiving $690,000 in monetary support alone.

A weak relationship between projects' ATE award and combined external support (monetary and in-kind) was found (see Figure 7). That is, projects with larger awards are slightly more likely to successfully leverage additional support—either monetary, in-kind, or both.



Note. *** Correlation is significant at the $p = .01$ level (two-tailed).

Figure 7: Relationship Between External Support and ATE Award

Survey respondents were also asked to rate their most effective collaborative partnership, whether other ATE-funded projects or non-ATE institutions. One-third of respondents (33%) rated other education institutions as their most effective collaborative partnership, followed closely by business and industry (30%). Only 5 percent of respondents named other ATE projects as their most effective collaborative relationship.

These respondents also provided their views of the most important elements for effective collaboration with outside organizations. Figure 8 summarizes their responses.

Most Important Elements for Effective Collaboration

- ✓ Common goals and objectives
- ✓ Communication
- ✓ Reciprocity
- ✓ Action

Figure 8: Projects' View of Most Important Elements for Effective Collaboration

Project Productivity in ATE Work Categories

The ATE program guidelines[12] indicate that the ATE projects' activities should narrowly focus on one or more of the primary categories of work (also see Figure 3, p. 7):

- ✓ Curriculum and educational materials development for national dissemination
- ✓ Professional development for educators
- ✓ Program improvement efforts
- ✓ Articulation between programs

This section of the report examines the extent to which the ATE projects and articulation partnerships are productive in these key activities and meeting ATE's expectations as indicated in the ATE Program Solicitation (NSF-02-035).

***Materials development*.** The ATE program guidelines indicate that materials development

> . . . activities should result in textbooks, laboratory experiments and manuals, software, CD-ROMs, videos, or other courseware that will be published for national distribution to colleges, secondary schools, or industry

The findings here are used to examine the basic elements of these expectations. Ninety (68%) responding projects and articulation partnerships reported developing materials in the past 12 months. Table 13 summarizes their materials development activities with regard to stages of development, materials distribution, target audiences, and media of the materials.

Overall, respondents reported developing 2,306 courses, modules, and other materials in the past 12 months. Modules are the most frequently developed materials, accounting for half of the total reported by respondents, with other materials accounting for one-third (32%) and courses accounting for less than 20 percent of the total. Six (7%) respondents reported developing all 3 types of materials with the remaining (93%) developing only a single type or combination of 2 types.

[12] Advanced Technological Education (2002). *Program Solicitation NSF-02-035*.

Table 13: Project Materials

	Course					Module					Other Materials				
	N	**%**	***M***	***SD***	**Total**	***N***	**%**	***M***	***SD***	**Total**	***N***	**%**	***M***	***SD***	**Total**
Material Development Stage															
Draft Stage	24	27%	5.4	9.0	129	37	41%	14.3	47.7	528	13	14%	37.5	109.4	488
Field Tested	23	26%	5.1	7.2	118	41	46%	7.8	15.5	320	7	8%	17.9	36.3	125
Complete	27	30%	6.1	6.2	165	33	37%	9.3	19.3	307	16	18%	7.9	10.3	126
Material Distribution															
Local use	36	40%	7.3	6.6	262	42	47%	10.6	15.9	447	11	12%	50.4	149.2	554
Elsewhere	12	13%	128.7	416.6	1,544	31	34%	14.8	31.8	458	13	14%	102.2	263.6	1,328
Com. Publ.[13]	1	1%	1.0	0.0	1	5	6%	9.6	12.8	48	1	1%	1.0	0.0	1
Numbers Distributed	15	17%	229.9	480.4	3,449	32	36%	181.7	339.5	5,814	15	17%	1,242.0	4,090.4	18,630
Target Audiences															
Secondary	14	16%	6.9	18.2	97	29	32%	9.9	13.8	287	13	14%	13.1	19.8	170
Associate	42	47%	6.6	8.3	277	44	49%	17.0	44.0	748	18	20%	151.6	500.0	2,728
Baccalaureate	13	14%	7.1	11.7	92	19	21%	9.4	9.1	179	9	10%	9.2	19.3	83
Other	3	3%	3.3	2.1	10	9	10%	8.4	8.5	76	8	9%	8.8	20.7	70
Instructional Media of Materials															
Print	21	23%	8.5	13.8	179	28	31%	19.6	54.5	550	13	14%	3.5	3.2	46
Audio/Video	4	4%	8.3	5.6	33	3	3%	23.3	9.9	70	7	8%	30.9	74.6	216
CD-ROM	5	6%	2.4	2.6	12	5	6%	10.2	6.8	51	10	11%	5.7	8.9	57
Online	29	32%	15.0	36.4	435	11	12%	3.3	3.1	36	9	10%	69.3	162.9	624
Mixed Media	19	21%	8.8	14.1	167	24	27%	10.7	10.5	256	9	10%	11.0	19.0	99
Other	6	7%	7.5	11.3	45	9	10%	28.9	64.8	260	1	1%	6.0	0.0	6

Note. *N* = 90.

Two ATE projects account for almost half (48%) of all materials developed. These 2 projects developed 1,102 of 2,306 total materials produced, which were primarily modules (online, print, and audio/video). These include materials in draft stage as well as those being field tested and completed.

Our primary indicator of materials development productivity—materials distributed—showed that a single project accounted for 16,000 (57%) of the total of 27,893 (see Figure 9).

[13] Commercial Publication

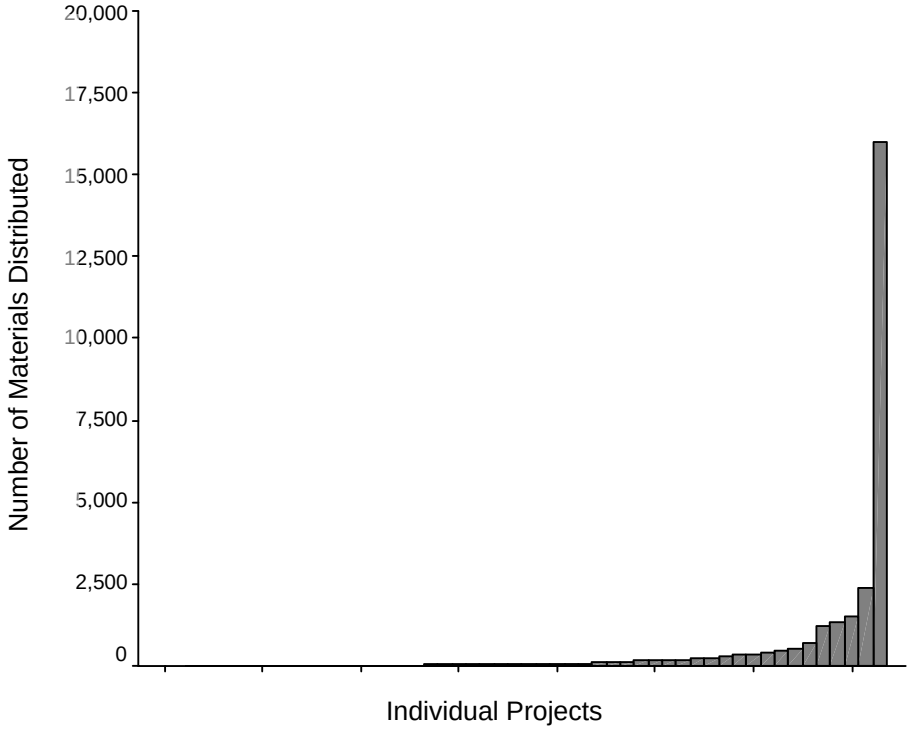


Figure 9: Total Project Materials Distributed[14]

The projects employed a wide variety of media to present project-developed materials. In contrast to typical commercial publishers' use of print materials, these projects tend to publish their course and other materials online. Modules tend to be distributed in print form.

Project materials are overwhelmingly targeted toward an associate degree level audience, with 78 percent of courses, modules, and other materials directed toward this audience. Although substantially smaller numbers are targeted toward secondary and baccalaureate audiences, respondents did report 287 and 179 modules directed toward the secondary and baccalaureate levels respectively.

Practices used during development of materials by the ATE projects and articulation partnerships were solicited on the premise that good development practices are likely to produce high quality materials. Three general practices were addressed:

- ✓ Assurance of content validity
- ✓ Testing of materials during development
- ✓ Measures to assess student success

More than 80 respondents reported the use of industry standards or other guidelines in the development of their materials. For example, ATE projects gathered input from business and industry to assess workforce needs (*M* = 4.1, *SD* = 1.2, *N* = 81), used

[14] The horizontal axis represents individual ATE projects.

applicable student and industry standards or guidelines (*M* = 4.0, *SD* = 1.4, *N* = 82), and verified alignment of materials with workforce needs (*M* = 4.2, *SD* = 1.2, *N* = 84)[15] in developing their materials.

Respondents indicated their projects internally pilot (*M* = 4.2, *SD* = 1.1) and field-test their materials most of the time (*M* = 4.3, *SD* = 1.1, *N* = 79) and use external field tests approximately half the time (*M* = 3.2, *SD* = 1.5, *N* = 77).[16]

Projects and articulation partnerships also reported a variety of methods used in disseminating their materials nationally. The most frequently cited methods for dissemination reported by projects were project Web sites/Internet, conferences-workshops, professional publication, mailing lists, and the annual PI meeting.

Two separate items suggest that a majority of projects are ready to address or are engaged in addressing the national distribution emphasis of this program. Forty-five projects stated they have distributed materials externally, and 63 indicated that a total of 1,805 (*M* = 28.7, *SD* = 47.4) external institutions were using at least 1 project-developed material.

Nearly 20 percent of the 90 materials developers did not respond to a question regarding the degree to which they are achieving the goal of national dissemination of their developed materials. Among those that did respond, most think they are successful in achieving this goal[17] (*M* = 3.2, *SD* = 1.1, *N* = 74).

***Professional development*.** Professional development is described by NSF[18] as

> Providing current secondary school teachers and college faculty with opportunities for continued growth in areas that directly impact advanced technological education," and "should be designed to enhance the educator's disciplinary capabilities, teaching skills, vitality, and understanding of current technologies and practices"

One hundred eight (81%) projects and articulation partnerships reported conducting technological education professional development activities for faculty and staff members at the secondary, associate, and baccalaureate levels. A total of 2,017 (from short-term events to long-term programs) opportunities for professional development were offered by ATE projects in the previous 12 months (see Table 14).

[15] From 1 = never used to 5 = used each time.
[16] From 1 = never used to 5 = used each time.
[17] From 1 = not successful to 5 = highly successful.
[18] Advanced Technological Education (2002). *Program Solicitation NSF-02-035*.

Table 14: Number of Professional Development Opportunities for Projects

Opportunities for Professional Development	Total	*M*	*SD*	*N*	%
Events	494	5.1	5.6	97	90%
Events with Follow-Up Activities	113	2.7	2.9	42	39%
Long-Term Programs	243	7.6	22.0	32	30%
Internships	65	4.6	6.2	14	13%
Self-Study Programs	1,084	60.2	234.7	18	17%
Other	18	2.6	2.1	7	7%

Note. *N* = 108.

More than 12,000 people attended project and articulation partnership-sponsored professional development activities. Events and events with follow-up activities comprised the largest proportion of center professional development (see Table 15).

Table 15: Number of Professional Development Participants for Projects Across Education Levels

Opportunity	Education Level	Total	*M*	*SD*	*N*	%
Events	Secondary	4,378	60.8	127.5	72	67%
	Associate	3,576	50.4	76.9	71	66%
	Baccalaureate	1,459	26.5	36.8	55	51%
Events With Follow-Up Activities	Secondary	602	20.8	20.2	29	27%
	Associate	472	18.2	21.3	26	24%
	Baccalaureate	230	11.5	10.3	20	19%
Long-Term Programs	Secondary	356	18.7	15.2	19	18%
	Associate	376	15.0	18.6	25	23%
	Baccalaureate	108	9.8	10.4	11	10%
Internships	Secondary	55	9.2	3.7	6	6%
	Associate	76	6.9	8.8	11	10%
	Baccalaureate	17	2.4	2.3	7	7%
Self-Study Programs	Secondary	108	21.6	34.7	5	5%
	Associate	147	16.3	13.6	9	8%
	Baccalaureate	56	6.2	8.3	9	8%
Other	Secondary	26	8.7	6.0	3	3%
	Associate	80	16.0	21.3	5	5%
	Baccalaureate	6	3.0	1.4	2	2%

Note. *N* = 108.

As illustrated in Figure 10, 2 projects were especially productive. Together they reached 1,870 participants, 15 percent of all professional development participants

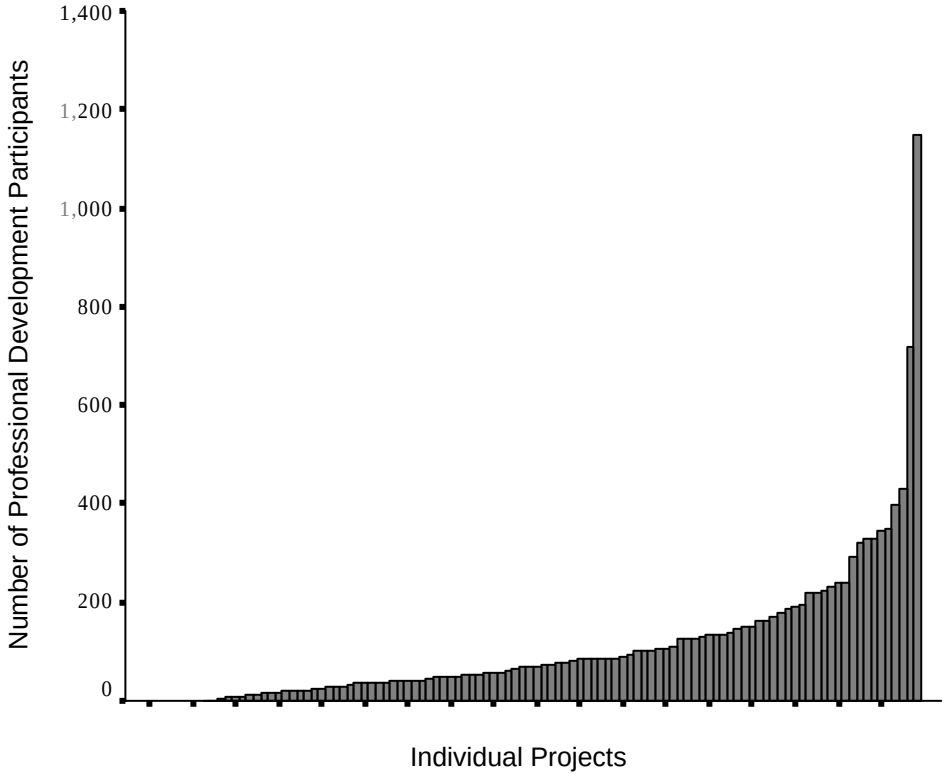


Figure 10: Total Project Professional Development Participants[19]

As illustrated in Figure 11, offering more professional development opportunities does not necessarily imply that a larger number of participants will attend these events (r = .050, p = .627 *ns*). As an example, the 2 projects that reported the largest number of participants (see Figure 10) offered relatively few opportunities (2 and 5 respectively). And as illustrated in Figure 11, the project that offered the largest number of opportunities (1,133) had a very low participation rate with fewer than 200 total participants.

[19] The horizontal axis represents individual ATE projects.

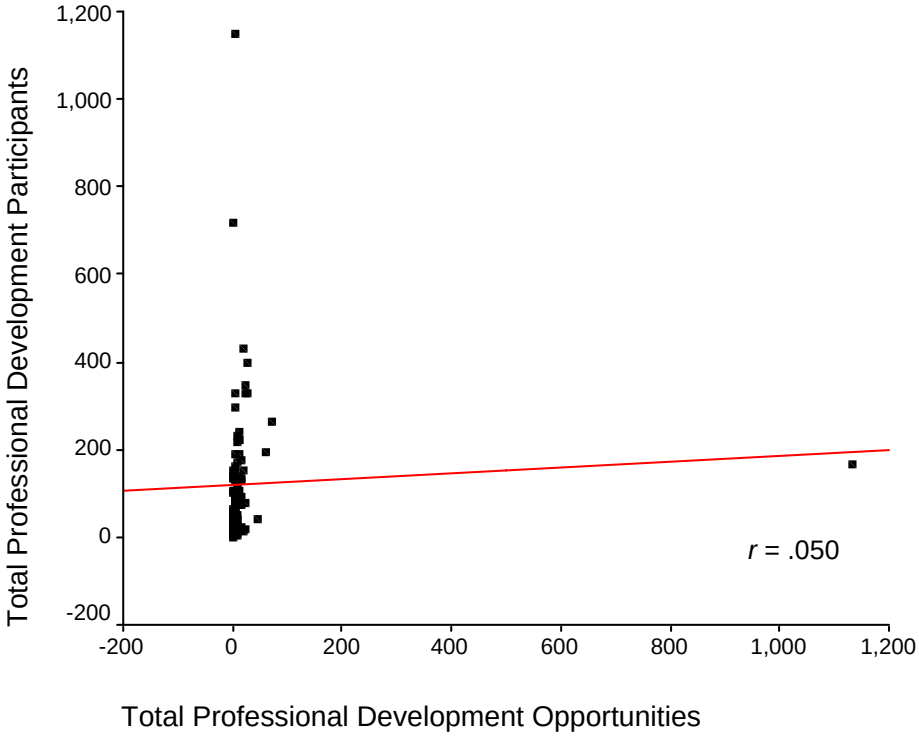


Figure 11: Relationship between Professional Development Opportunities and Number of Participants

Professional development participation is summed up in Table 16. That table shows professional development efforts in terms of the numbers of projects that engaged in each type of professional development activity. For engaged projects it provides an overall average of the percentage of participants who responded positively for each identified use or outcome. For each type of professional development activity, three issues were addressed: participants' intent to use information or materials, participants' trial or implementation of new ideas and materials, and participants' report of an increase in student achievement through such implementation.

The table shows that for the typical (average) project that engaged in professional development activities, the large majority of its participants reported the intention to use the information provided to them. The majority of participants also reported trial/implementation of the ideas or materials. Note that while the number of projects engaging in the more extensive activities decreases as longevity of an activity increases, implementation of ideas and materials tends to increase. *That is, the probability of implementation goes up when participants engage more extensively.* A similar effect occurs for student achievement. When participants engage in the more extensive professional development activities, they are also more likely to report a concomitant increase in student achievement.

Table 16: Participants' Affirmation of Outcomes from Professional Development Activities'

Opportunity	Outcomes	Project Engagement		Percent Participation Affirmation per Project	
		N	**% Responding**	***M***	***SD***
Events	Intent to Use Information	86	80%	86.9%	17.4%
	Tried or Implemented New Materials or Ideas	55	51%	63.7%	34.5%
	Student Achievement Increased Due to Implementation	34	31%	63.2%	31.8%
Events with Follow-Up Activities	Intent to Use Information	38	35%	84.2%	24.9%
	Tried or Implemented New Materials or Ideas	28	26%	70.6%	36.3%
	Student Achievement Increased Due to Implementation	17	16%	65.2%	31.0%
Long-Term Programs	Intent to Use Information	31	29%	87.6%	25.0%
	Tried or Implemented New Materials or Ideas	24	22%	77.3%	32.5%
	Student Achievement Increased Due to Implementation	15	14%	74.7%	21.9%
Internships	Intent to Use Information	13	12%	88.5%	26.2%
	Tried or Implemented New Materials or Ideas	7	6%	87.1%	29.8%
	Student Achievement Increased Due to Implementation	3	3%	83.3%	15.3%
Self-Study Programs	Intent to Use Information	14	13%	74.6%	40.1%
	Tried or Implemented New Materials or Ideas	9	8%	76.1%	35.5%
	Student Achievement Increased Due to Implementation	7	6%	84.3%	23.7%
Other	Intent to Use Information	4	4%	90.0%	11.5%
	Tried or Implemented New Materials or Ideas	4	4%	81.3%	23.9%
	Student Achievement Increased Due to Implementation	2	2%	50.0%	0.0%

Note. *N* = 108.

Most of the ATE projects that were engaged in professional development activities indicated that they conducted at least one method of follow-up with their professional development participants. Overall, the most common form of follow-up[20] was end-of-program reaction data (*M* = 4.4, *SD* = 1.0, *N* = 105) and to a somewhat lesser extent data to determine implementation (*M* = 3.7, *SD* = 1.3, *N* = 100). For each type of professional development opportunity, only a small proportion of engaged projects collected data to determine its impact on student achievement (*M* = 3.1, *SD* = 1.5, *N* = 101).

The ATE projects reported that they are, in fact, achieving their professional development goals through

- enhanced disciplinary skills (*M* = 4.1, *SD* = 0.8)
- enhanced educator teaching skills (*M* = 4.2, *SD* = 0.8)
- enhanced usage of educational technologies (*M* = 4.1, *SD* = 0.9)
- enhanced understanding of current technologies and practices (*M* = 4.3, *SD* = 0.8)[21]

Projects were asked to describe their claims for effects: ". . . describe the evidence available to support your responses regarding the degree to which your project/center/partnership is achieving professional development goals." Figure 12 displays several statements received from ATE projects and articulation partnerships.

Evidence to support achievement of professional development goals:

- ✓ Results of postinstruction evaluations indicate that all instructors found the professional development activities highly rewarding and either planned immediate adoption or hoped to adopt as soon as local budgets would support the initiative.
- ✓ Evaluation by outside evaluator
- ✓ Through follow-up discussions and degree of implementation
- ✓ Follow-up evaluations of workshop attendees indicate high levels of satisfaction and incorporation of workshop materials.

Figure 12: Evidence Supporting Achievement of Professional Development Goals

Although responses varied widely, a majority of respondents indicated evaluation and follow-up activities as evidence of the effectiveness of their professional development activities.

[20] From 1 = never collected to 5 = always collected.
[21] From 1 = not successful to 5 = highly successful.

Program improvement. Program improvement encompasses the ATE projects' efforts at the construction of new programs, courses, and modification of existing courses. Eighty-six of the 133 (65%) ATE projects provided information for program improvement efforts. These data provide indicators of program improvement impact. This section focuses on the following information:

- ✓ Programs, locations, courses, and students at the secondary, associate, and baccalaureate levels and on-the-job training
- ✓ Student status
- ✓ Program model representation
- ✓ Dissemination of program

Figure 13 shows the programmatic level of involvement for 67 projects. Almost half work exclusively with associate degree students; and 4 work with 3 or more education levels.

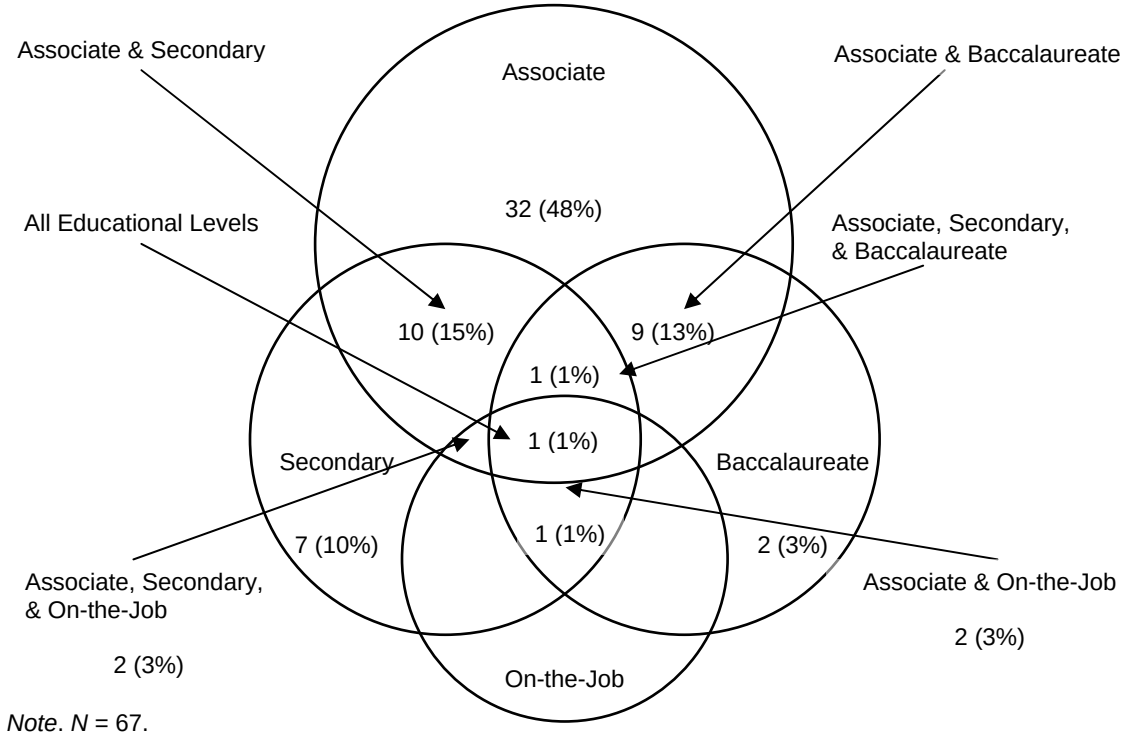


Figure 13: Combinations of Project Program Improvement Efforts

Respondents reported that 273 ATE-funded programs were offered or developed across 549 locations; these programs consisted of 905 courses. Proportionally, the largest number of programs, locations, and courses were at the associate level (see Table 17).

Table 17: Number of Project Programs, Locations, and Courses Across Education Levels

	Total	*M*	*SD*	*N*	%
Number of ATE-Funded Programs Developed/Offered					
Secondary	42	2.2	1.7	19	22%
Associate	162	2.5	3.4	65	76%
Baccalaureate	21	1.6	1.3	13	15%
On-the-Job	48	4.8	4.5	10	12%
Number of Locations Where ATE-Funded Programs Offered					
Secondary	176	9.3	15.5	19	22%
Associate	272	5.1	7.8	53	62%
Baccalaureate	42	3.2	3.7	13	15%
On-the-Job	59	5.4	4.1	11	13%
Number of Unique Courses Offered Across ATE-Funded Programs					
Secondary	61	3.2	2.4	19	22%
Associate	746	13.1	27.6	57	66%
Baccalaureate	79	8.9	12.3	9	10%
On-the-Job	19	2.4	1.7	8	1%

Note. *N* = 86.

As can be seen in Figure 14, 3 projects accounted for 9,537 (47%) of the 20,080 students who have taken at least 1 course in the past 12 months.

Each project was asked to describe the degree to which its program represents a model. Overall, the projects indicated that they were successful[22] (*M* = 4.2, *SD* = 0.8) in achieving this program improvement goal. They also reported that they were successfully[23] disseminating their programs (*M* = 3.4, *SD* = 1.1). Projects supported their claims of achieving these goals through open-ended responses. These responses are summarized in Figure 15.

[22] From 1 = not successful to 5 = highly successful.
[23] From 1 = not successful to 5 = highly successful.

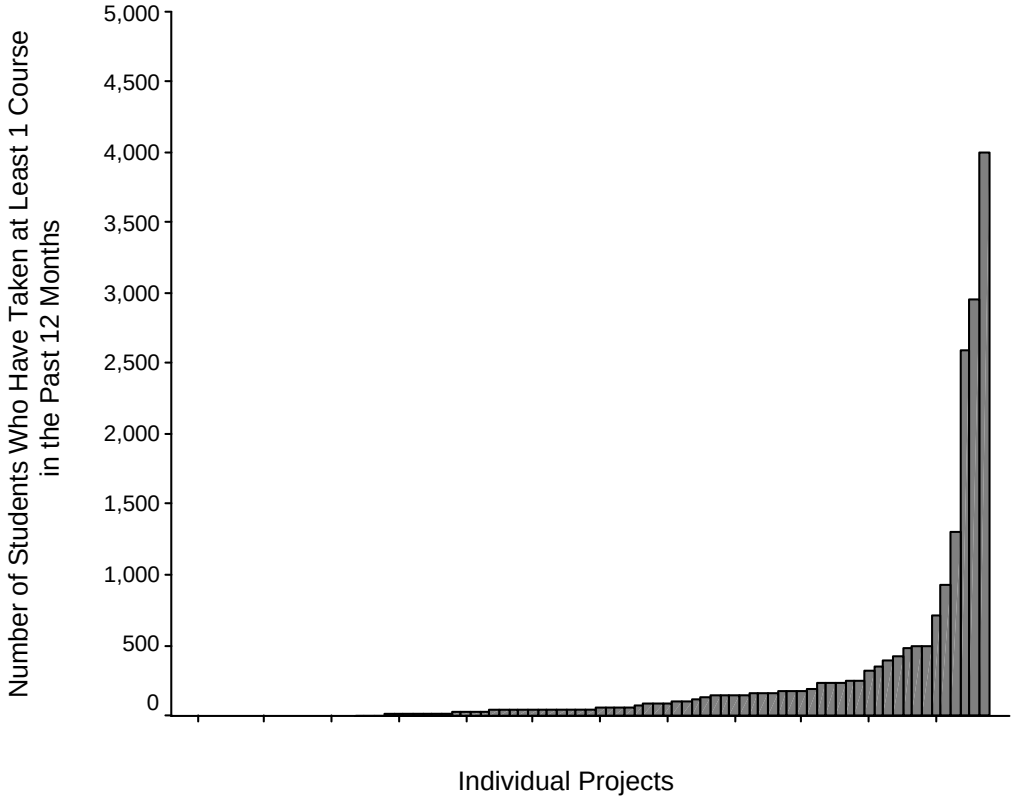


Figure 14: Total Number of Students Who Have Taken at Least 1 Course in the Past 12 Months[24]

Evidence Supporting Success in Creating a Model for Program Improvement

- ✓ Increased enrollment—our program realized full enrollment this year, the first full enrollment in six years . . . high employment level after graduation—overall employment of 2003 graduates is approximately 80%
- ✓ Graduate survey indicates that 80% of the students have entered postsecondary education or independent study. Another indicator is that 30% of the schools have made their own investment to expand the project.
- ✓ External evaluator feedback & reports
- ✓ Evidence to support the achievement of our goals can be seen by our graduation
- ✓ Industry survey of graduates . . . we have compared our graduates with other students at the college

Figure 15: Evidence Supporting Success in Creating a Model for Program Improvement

[24] The horizontal axis represents individual ATE projects.

Articulation between programs. Articulation agreements provide pathways for students to matriculate to a higher level of education and are typically collaborative efforts involving two-year colleges, four-year colleges and universities, and secondary schools. These agreements enhance the ability of two-year college students to transfer to four-year programs, thus improving the quality of these students' preparation for entrance into the workforce. This section of the report addresses articulation agreements for students preparing for careers as technicians as well as teacher preparation agreements. The ATE *projects* and ATE *articulation partnerships* reported on their overall articulation activities as well as a single agreement that was in place.

Seventy-two of the 133 (54%) responding ATE projects reported engaging in articulation activities. Of the 54 percent of projects responding, the large majority (66) were regular *projects* with only 6 having received funding as *articulation partnerships*.

In total, *projects* and *articulation partnerships* reported 295 articulation agreements in place across 517 institutions (see Table 18). Almost two-thirds (57%) were agreements between high schools and 2-year colleges, while one-third (31%) were between 2- and 4-year colleges and 1 in 10 (10%) served teacher preparation–high schools to 2-year colleges.

Articulation Partnerships produced fewer agreements but engaged nearly twice the number of institutions. On average, *projects* reported engaging in 7 articulation agreements with 13 other institutions (fewer than 2 institutions per agreement). In contrast *articulation partnerships* reported an average of 1 articulation agreement involving partnerships with 21 other institutions.

Table 18: Number of Project Articulation Agreements and Institutions Involved

Type of Articulation Agreement		Total	*M*	*SD*	*N*	%
Number of Articulation Agreements						
High Schools to 2-Year Colleges	Articulation Partnership	1	1.00	0.00	1	1%
	Project	167	8.35	12.71	20	28%
2-Year to 4-Year Colleges	Articulation Partnership	2	1.00	0.00	2	3%
	Project	92	2.87	3.70	32	44%
Teacher Preparation- High Schools to 2-Year Colleges	Articulation Partnership	3	1.00	0.00	3	4%
	Project	30	3.00	3.53	30	42%
Number of Institutions Involved in Articulation Agreements						
High Schools to 2-Year Colleges	Articulation Partnership	12	12.00	0.00	1	1%
	Project	237	11.85	11.91	20	28%
2-Year to 4-Year Colleges	Articulation Partnership	5	2.50	0.71	2	3%
	Project	125	3.91	4.53	32	44%
Teacher Preparation- High Schools to 2-Year Colleges	Articulation Partnership	42	21.00	26.87	2	3%
	Project	96	9.6	12.39	10	14%

Note. *N* = 72.

A total of 1,001 students matriculated to higher level institutions in the past 12 months—under all 3 types of agreements: secondary to 2-year, 2-year to 4-year, and teacher preparation (see Table 19). Each type of agreement served approximately 300 students. Articulation partnerships have not yet matriculated students in 2 of the categories. But they show substantial productivity on the third, teacher preparation. In that category, each *articulation partnership* project served 83 students on average, almost 3 times the productivity of its *project* counterpart.

Table 19: Number of Project Students Who Articulated in the Past 12 Months

		Total	*M*	*SD*	*N*	%
Number of Students Who Articulated						
High Schools to 2-Year Colleges	Articulation Partnership	0	0.00	0.00	0	0%
	Project	371	26.50	40.74	14	19%
2-Year to 4-Year Colleges	Articulation Partnership	0	0.00	0.00	0	0%
	Project	279	12.13	15.64	23	32%
Teacher Preparation High Schools to 2-Year Colleges	Articulation Partnership	166	83.00	74.95	2	3%
	Project	185	30.83	40.12	6	8%

As illustrated in Figure 16, 5 projects accounted for almost half (41%) the total number (1,001) of articulating students reported for the last 12-month period. Of these 5 projects, 1 was an ATE *articulation partnership*.

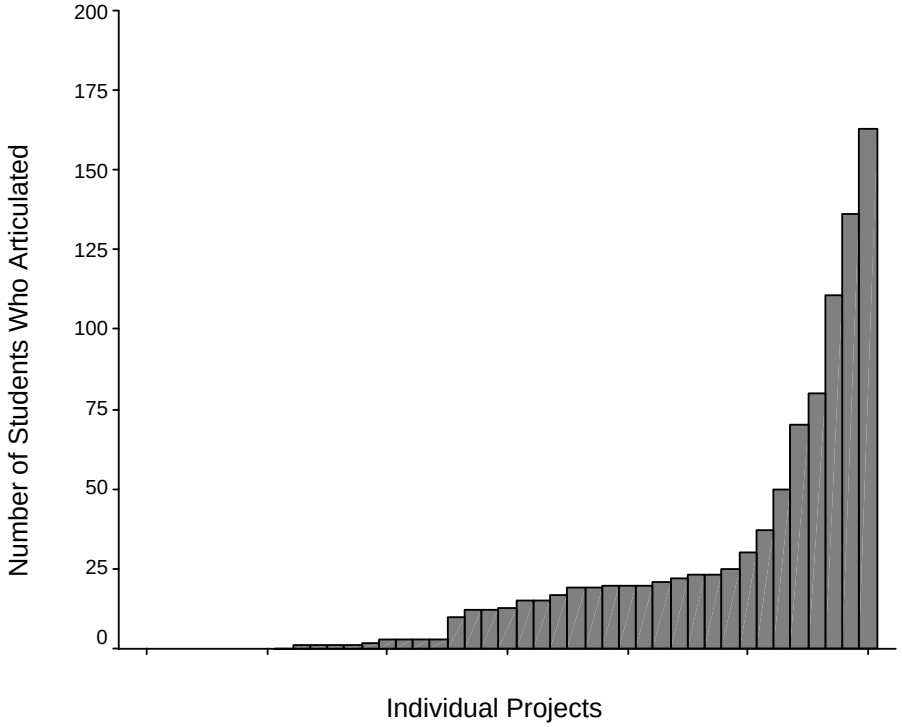


Figure 16: Total Students Who Articulated in Past 12 Months

In addition to their overall articulation activities, projects were asked to provide in-depth information on a single, project-specified articulation agreement. Under these single project-specified articulation agreements, respondents reported that a total of 242 institutions were involved and 749 students articulated (see Table 20). Although the number of agreements is large, only slightly more than 20 students matriculated under each agreement, on average.

Table 20: Number of Institutions and Students in Specific Project Articulation Agreements

		Total	***M***	***SD***	***N***	**%**
Number of Institutions Involved in Specified Agreements	Articulation Partnership	49	9.80	16.89	5	7%
	Project	193	4.29	5.60	45	63%
Number of Students Who Articulated Under Specified Agreements	Articulation Partnership	171	42.75	63.51	4	6%
	Project	578	18.06	18.86	32	44%

Note. *N* = 72.

Of the 749 students who articulated in the past 12 months under project-specified agreements, the ratio of male to female students matriculating to higher level education was almost 1:1 (see Table 21).

Table 21: Gender Demographics of Students Who Articulated Under Project-Specified Agreements in the Past 12 Months

	Total	***M***	***SD***	***N***	**%**
Male Students Who Articulated in the Past 12 Months	470	15.2	22.2	31	43%
Female Students Who Articulated in the Past 12 Months	529	18.9	29.1	28	39%

Note. *N* = 72.

Ten percent of these students were Hispanic/Latino, 12 percent were American Indian/Alaska Natives, 6 percent were Asian, 10 percent were Black/African American, less than 1 percent were Native Hawaiian/Pacific Islander, 3 percent were Multiracial, and the remaining 58 percent were White/Caucasian. Proportionally, White/Caucasian students outnumber all other students who articulated 2:1. Eight respondents reported that 14 students requested ADA accommodations. Under these specified agreements, 57 percent of responding projects indicated that some or all of the general education credits for specific courses transferred, 57 percent reported that some or all of the technical education credits for specific courses transferred, 53 percent indicated that program completion allowed students to matriculate at selected institutions, and 46 percent reported that program completion allowed students to matriculate to selected institutions with standing (see Table 22).

Table 22: Characteristics of Project-Specified Articulation Agreement

		N	**%**
Some or All of the General Education Credits for Specific Courses Transfer	Articulation Partnership	5	7%
	Project	36	50%
Some or All of the Technical Education Credits for Specific Courses Transfer	Articulation Partnership	3	4%
	Project	38	53%
Program Completion Allows Students to Matriculate to Selected Institutions	Articulation Partnership	5	7%
	Project	33	46%
Program Completion Allows Students to Matriculate to Selected Institutions with Standing	Articulation Partnership	4	6%
	Project	29	40%

Note. *N* = 72.

Overall, the ATE projects and articulation partnerships described their selected agreements as displayed in Figure 17.

Descriptions of Single Articulation Partnership

- ✓ Allows students to transition smoothly to a 4-year degree institution
- ✓ Students guaranteed transfer to upper division institution upon completion of curriculum and graduation from 2-year college.
- ✓ Aligns high school curricula with the community college
- ✓ All credits taken at the 2-year institution given full equivalent credit at the senior college and do not have to be repeated.

Figure 17: Descriptions of Single Articulation Partnership

Project Impact on Students

The overarching goal of the ATE program is to increase the number and quality of technicians in the United States and, as a result, positively impact the workforce in technological disciplines. Previous sections of this report focused on ATE's work to improve the quality of instruction for technician programs through collaborations, materials development, professional development of faculty, and improvements and increased dissemination of improved instructional programs.

Here attention is given to outcomes of these programs. Specifically, this section attends the question "To what extent do students complete these programs and/or enter the technician fields?" In these regards the ATE program's objectives include not just contributions to the technician workforce, but increasing the numbers of female and minority students trained in technology fields as well.

Of the 86 projects responding to questions about student instructional programs, their responses indicate that more than 20,000 students participated in these programs during the past year (see Table 23).[25]

Table 23: Number of Students Who Have Taken an ATE-Funded Course in Past 12 Months

	Total	***M***	***SD***	***N***	**%**
Number of Unique Students Who Have Taken at Least 1 ATE-Funded Course in the Past 12 Months					
Secondary	5,148	214.5	421.2	24	28%
Associate	10,871	184.3	529.5	59	69%
Baccalaureate	1,044	80.3	133.6	13	15%
On-the-Job	3,017	274.3	821.4	11	13%

Note. *N* = 86.

Additionally, these projects reported that 9,661 individuals applied to their programs and enrolled 8,152 new students in the past 12 months (see Table 24) across all education levels.

[25] Tabular results vary depending upon whether the questions regard numbers enrolled or characteristics of students (e.g., ethnicity and sex). All, however, indicate that enrollments are 20,000 or higher.

Table 24: Number of Project Applicants, Acceptances, and Newly Enrolled Students

	Total	*M*	*SD*	*N*	%
Number of Applicants in the Past 12 Months					
Secondary	1,471	77.4	82.0	19	22%
Associate	8,024	157.3	560.8	51	59%
Baccalaureate	166	18.4	10.1	9	10%
Number of Students Accepted in the Past 12 Months					
Secondary	1,334	78.5	74.7	17	20%
Associate	11,958	234.5	720.7	51	59%
Baccalaureate	119	14.9	10.5	8	9%
Number of Newly Enrolled Students in the Past 12 Months					
Secondary	2,640	139.0	290.2	19	22%
Associate	5,375	101.4	286.6	53	62%
Baccalaureate	137	15.2	8.5	9	10%

Note. *N* = 86.

Program enrollment reports indicated that nearly 35,000 students enrolled across all levels. The associate degree level captured nearly half of this enrollment, with secondary school levels also enrolling a large number. Also, nearly 14 percent of the students work on the job during their program enrollment (see Table 25).

Table 25: Students Enrolled in Project Programs Across Education Levels

Education Level	Total	*M*	*SD*	*N*	%
Secondary	12,285	558.4	1,915.6	22	26%
Associate	15,989	280.5	724.7	57	66%
Baccalaureate	1,639	117.1	314.2	14	16%
On the Job	4,760	793.3	1,229.0	6	7%

Note. *N* = 86.

A total of 2,938 ATE project students (8%) were employed as technicians prior to enrollment in project programs (see Table 26), including on-the-job training.

Table 26: Project Students Employed as Technicians Prior to Enrollment

	Total	*M*	*SD*	*N*	%
Employed as Technician Prior to Enrollment					
Secondary	258	129.0	161.2	2	2%
Associate	1,651	59.0	123.5	28	33%
Baccalaureate	14	4.7	4.7	3	3%
On-the-Job	1,015	507.5	696.5	2	2%

Note. *N* = 86.

Projects reported a total of 8,571 students (25% of the 34,673 enrolled students) remaining in their programs (see Table 27). We anticipate that these remaining students will carry over into the 2005 academic year.

Table 27: Students Remaining in Project Programs

	Total	*M*	*SD*	*N*	%
Students Remaining in Program					
Secondary	719	55.3	52.3	13	15%
Associate	6,505	151.3	420.6	43	50%
Baccalaureate	309	30.9	45.7	10	12%
On-the-Job	1,038	346.0	566.6	3	3%

Note. *N* = 86

The ATE program's impact on the U.S. workforce was addressed through disaggregation of information on program completers, program dropouts, and persons who continued employment while participating in the ATE program. Project respondents were asked to provide employment numbers for students: who completed their programs during the last 12 months, who left programs prior to completion, and who started or continued employment as a technician while participating in the program. In concert, respondents were asked to report the numbers of students who started or continued STEM education after completing or dropping from the ATE program.

A total of 6,689 students completed project programs. Of these 1,844 (28%) started or continued employment in the technological workforce and 6,301 (94%) started or continued their STEM education. A total of 2,589 students left project programs prior to completion. Of these, more than one-third (33%) started or continued employment in the technological workforce and more than half (57%) started or continued STEM education. Combining completers and those who left the program prior to completion, we have a total cohort of 9,278 students. Of these, almost three-fourths (72%) completed an ATE program, while only slightly more than one-fourth (28%) left prior to completion. Detailed results by education level are displayed in Table 28.

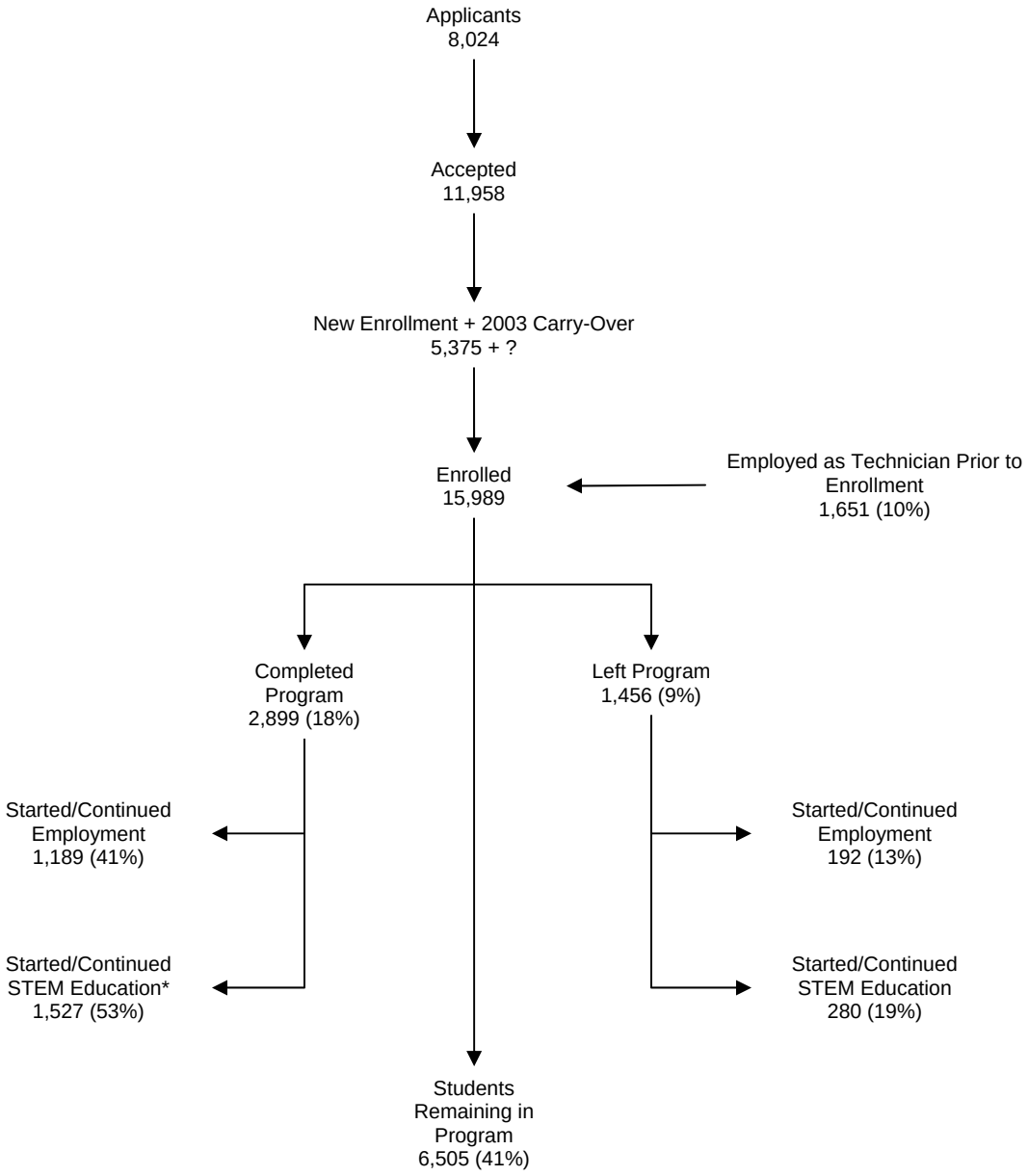
Table 28: Project Students Who Completed and Left Programs

	Students Who Completed Program					Students Who Left Program Prior to Completion				
	Reporting Projects		Student Results			Reporting Projects		Student Results		
	N	*%*	*M*	*SD*	*Total*	*%*	*N*	*M*	*SD*	*Total*
Secondary	15	17%	94.7	92.4	1,421	7	8%	18.1	36.3	127
Associate	41	`48%	70.7	166.5	2,899	34	40%	42.8	170.9	1,456
Baccalaureate	8	9%	12.4	10.8	99	3	3%	2.0	1.0	6
On-the-Job	4	5%	567.5	924.9	2,270	1	1%	1,000.0	0.0	1,000
	Students Who Completed or Left the Program AND Started/Continued Employment as Technician									
Secondary	4	5%	8.8	8.4	35	3	3%	23.7	31.7	71
Associate	26	30%	45.7	110.2	1,189	10	12%	19.2	24.6	192
Baccalaureate	2	2%	2.5	0.7	5	1	1%	0.0	0.0	0
On-the-Job	2	2%	307.5	413.7	615	1	1%	600.0	0.0	600
	Students Who Completed or Left the Program AND Started/Continued STEM									
Secondary	6	7%	51.5	61.9	309	3	3%	66.7	76.4	200
Associate	25	29%	195.4	673.6	1,527*	8	9%	35.0	42.6	280
Baccalaureate	8	9%	13.5	12.9	108	0	0%	0.0	0.0	0
On-the-Job	1	1%	1,000.0	0.0	1,000	1	1%	1,000.0	0.0	1,000

Note. *N* = 86.

Note. *A single outlying case of 3,357 was removed.

Figure 18 illustrates the various outcomes for participants at the associate degree level. That diagram depicts the various enrollment, completion, and employment options. Of the nearly 16,000 enrolled students, 10 percent were employed as technicians prior to enrollment. Almost 1 in 5 students completed the program, with another 2 in 5 remaining in the program—it is assumed that these remaining students will continue into the 2005 program year. Fewer than 1 in 10 students left the program prior to completion. More than half of the completing students started or continued STEM education, and more than one-third started or continued employment as technicians.



Note. *A single case value of 3,357 was removed because this project did not report data on any of the other outcome measures.

Figure 18: Student Outcomes for Associate Degree Students

Enrollment data provided the following general demographic results for sex and ethnicity:

- approximately one-third of program participants are female (32%).
- slightly more than one-fourth (31%) of these ATE students are minority.

By projecting from these attendance data to completion and employment findings, we estimate that approximately 2,000 women and 2,000 minorities annually complete an ATE program. Similarly, of the women and minorities who did not complete a full ATE program, an estimated 60 percent—700 women and 700 minorities—are either employed as technicians or continuing their STEM education.

These figures are comparable to previous years (c.f., Survey 2003: ATE Program Status and Trends[26]), though there was a slight drop in female enrollment (from 35% in 2003 to 32% in 2004). Women continue to be engaged in technological programs at much lower rates than other community college programs. Nationally, almost 60 percent of community college students are female (Kent, 2000).[27] However, as other data show, the proportion of women engaged in these technological education programs is roughly equal to the proportion of women nationally who obtain degrees in science and engineering versus other degrees (http://www7.nationalacademies.org/cwse/).

Table 29: Gender Demographics of Project-Enrolled Students

	Total	***M***	***SD***	***N***	**%**
Male Students Enrolled					
Secondary	2,739	152.2	324.4	18	21%
Associate	8,286	180.1	436.6	46	53%
Baccalaureate	558	62.0	114.5	9	10%
On-the-Job	3,987	664.5	996.4	6	7%
Female Students Enrolled					
Secondary	1,083	60.2	89.6	18	21%
Associate	5,230	109.0	369.6	48	56%
Baccalaureate	217	21.7	44.4	10	12%
On-the-Job	808	134.7	301.9	6	7%

Note. *N* = 86.

Minorities, however, are participating in ATE programs in close proportion to their attendance in associate degree institutions (Kent, 2000), between 25-30 percent nationally. As can be seen in Table 30, slightly more than one-fourth of project students are minorities (26%), while White/Caucasian students account for the remaining 76 percent.

[26] Available at http://www.wmich.edu/evalctr/ate/2003_ATE_Evaluation_SurveyReport.pdf

[27] Kent, A. P. (2000). Community college fall headcount enrollment by age and gender. In M. Patton (Ed.), *National profile of community colleges: Trends and statistics* (3rd ed.). Washington, DC: Community College Press.

Table 30: Racial/Ethnic Composition of Project-Enrolled Students

	Total	*M*	*SD*	*N*	%
Hispanic/Latino					
Secondary	319	29.0	68.2	11	13%
Associate	1,164	32.3	52.4	36	42%
Baccalaureate	506	84.3	199.7	6	7%
On-the-Job	53	13.3	10.0	4	5%
American Indian/Alaska Native					
Secondary	164	27.3	60.1	6	7%
Associate	351	35.1	93.3	10	12%
Baccalaureate	2	1.0	0.0	2	2%
On-the-Job	0	0.0	0.0	0	0%
Asian					
Secondary	37	3.7	3.0	10	12%
Associate	241	9.3	20.8	26	30%
Baccalaureate	4	1.0	0.0	4	5%
On-the-Job	10	10.0	0.0	1	1%
Black/African American					
Secondary	263	23.9	29.5	11	13%
Associate	1,059	32.1	86.8	33	38%
Baccalaureate	13	4.3	3.5	3	3%
On-the-Job	822	205.5	396.4	4	5%
Native Hawaiian/Pacific Islander					
Secondary	1	1.0	0.0	1	1%
Associate	11	2.8	2.9	4	5%
Baccalaureate	0	0.0	0.0	0	0%
On-the-Job	0	0.0	0.0	0	0%
Multiracial					
Secondary	18	3.6	3.8	5	6%
Associate	260	26.0	61.4	10	12%
Baccalaureate	9	3.0	3.5	3	3%
On-the-Job	2	2.0	0.0	1	1%
White/Caucasian					
Secondary	924	66.0	110.2	14	16%
Associate	8,774	230.9	669.0	38	44%
Baccalaureate	91	18.2	20.1	5	6%

On-the-Job	1,936	18.2	20.1	3	3%

Note. *N* = 86.

Projects reported very few requests for accommodations for disabilities (less than 1 person per 1,000 students)—see Table 31. These requests come primarily from students enrolled at the associate level (61%), which is consistent with the larger program enrollment numbers at this education level.

Table 31: Project Students Requesting ADA Accommodations

	Total	***M***	***SD***	***N***	**%**
Students Requesting ADA Accommodations					
Secondary	24	4.0	4.0	6	7%
Associate	42	2.6	2.2	16	19%
Baccalaureate	2	2.0	0.0	1	1%
On-the-Job	1	1.0	0.0	1	1%

Note. *N* = 86.

Conclusions and Recommendations

The introduction to this report identified five key questions or issues to be addressed. The ensuing sections reported on each of the five points. Here we sum up findings across projects on those five points to provide general ATE programmatic judgments. Overall, we judge the program's projects'-based performance to be sound. We've judged programmatic performance on two indicators to be fully positive, two as positive but with one or more caveats attached, and one as partially positive.

What is the Size and Scope of the ATE Projects?

In key respects the program is on target. Though relatively small in size with 158 projects meeting our survey criteria, the program's projects and articulation partnerships are widely distributed across the United States. The program meets its Congressional mandate with a heavy concentration on 2-year colleges; these funded colleges constitute approximately 10 percent of the U.S. population of community colleges.

While there are not specifications for program breadth and emphasis across technology fields, the program clearly funds a wide range of work. All ATE-specified technology fields were included among funded projects that reported here. Additionally, the scope of the program's project work spans all four of its primary work categories: professional development, materials development for national dissemination, program improvement, and articulation between education institutions.

Our source of concern hinges on breadth of focus by individual projects. Consistently, projects tend to work in multiple work categories. We found that nearly two-thirds of the projects have broad scopes, where we defined broad to be at least three of the four work categories. More than a third address all four categories. This widespread project level practice is disparate from the program's guidelines, as noted in the question on productivity below. At the extreme end, when projects engage in all categories of work, productivity drops.

To What Degree do ATE Projects Apply Rigorous Internal Practices in Their Operations?

We conclude that the ATE program applies rigorous internal practice, but we also note two general worries. NSF's policies for grants' management call for a "hands off" approach and give project directors great latitude in conducting their projects. But the program contains at least four elements intended to structure and help to ensure good overall program direction to project operations. These elements include interactions with NSF program staff, advisory committees (e.g., National Visiting Committees), needs assessments, and evaluative efforts.

In sum, the findings are positive for project rigor across the four elements. For example, the large majority of projects engage in at least three of the four areas. This indicates that most do attend to important matters of rigor. Project level interactions with NSF

staff members also seem particularly strong. Nearly all project directors attend the annual PI conference and interact with the program officer via e-mail.

Our concerns are primarily of amount of attention given to these areas. In many cases the amount of effort (one element of rigor) is relatively small. For example, nearly a third have not conducted workforce needs assessments to guide project work. Also, the average project expends just 3 percent of its budget on evaluation, well below the recommended amount of 5 to 10 percent of project budget (*EHR/NSF Evaluation Handbook*).

How Extensive are ATE Project Collaborations?

Our judgments regarding collaboration are uniformly positive—in programmatic terms, collaboration plays a huge role.

Three facts combine to suggest that collaborations are both extensive and a program strength. First, nearly all projects collaborate with other organizations and institutions. Second, monetarily, collaborators add approximately 14 percent to the overall ATE project capacity for the year. Third, the typical project reaches out to large numbers of collaborators (approximately 30 non-ATE funded institutions or organizations) to achieve project objectives. These factors of involvement, added support, and reach provide a substantial basis for strengthening the productivity of the ATE program.

These large numbers of collaboration carry substantial coordination and communications obligations. As such, we expect that most projects carry a heavy load in terms of collaborative efforts. Yet, the information provided to us suggests that projects fare well in these collaborations. The large amount of monetary and in-kind support, for example, is a major benefit to projects. Additionally, in a separate document, Volume I, we note that the number of collaborations is related to project productivity.

The findings also suggest that not all collaborations have equal merit or worth. Projects generally find collaborations with other non-ATE partners to be more productive than with ATE partners. In general, collaborations with other education institutions and business and industry seem to yield the best benefits.

How Productive are ATE Projects in Terms of the Primary ATE Work Categories?

Our indicators yield uniformly positive conclusions regarding productivity. The projects produce large numbers of materials, engage large numbers of people in professional development, produce changed (improved) programs and courses in many locations, and provide students pathways to higher level technician education. For each category, one to two project are outliers, providing a large proportion of the impact.

Even when the project outliers are discounted, the following averages show projects to be productive:

- materials development: 12 material items developed, 134 disseminated
- professional development reached 83 persons

- program improvement reached 127 students
- articulation made matriculation across educational levels possible for students

As noted in regard to program scope, most projects engage in at least three work categories. While productivity appears to be maintained when projects address up to three categories, it drops when projects focus on all four categories. Additionally, when projects address multiple categories of work, substantial productivity is still generally limited to one category.

The one area where comparisons were possible was articulation. We conclude that articulation partnerships tend to be stronger than projects that do articulation agreements as part of a larger agenda. Partnerships yield greater productivity in numbers of institutions engaged and student matriculated through articulation agreements.

What Impacts are ATE Projects Having on Students?

Impact on students appears to be quite positive. More than 20,000 students were actively engaged in the program this past year. In terms of the total national technology workforce, the numbers of students participating in this program and annually stepping from the program into technology positions is small. Yet, presuming the program continues, our findings suggest a substantial long-term impact on the workforce.

Most students completing the program either go into the technology workforce directly or continue their STEM education. Drop-out rate is small programwide; and even among those that drop out, a substantial proportion continue or enter the technology workforce. Additionally, there is continued interest in the program as evidenced by the large number of applicants and new enrollees. All of these indicators suggest that the program is well received and is having a substantial impact on students, factors which bode well for the long-term viability of the program and its impact on the technology workforce.

The one aspect of student findings that remains a bit problematic regards diversity. The program appears to be stable, not increasing or decreasing substantially, in terms of involving women and minority groups. Yet, involvement by both groups, especially women, is lower than NSF desires.

Recommendations

In large measure the ATE program's efforts related to projects appear to be on target. This suggests that the program should continue its current course. The suggestions below should be treated as items to explore rather than as mandates for change.

1. *Encourage the ATE projects to narrow their focus of work activities*. Approximately a third of the projects attempt to address all four categories of project work: materials development, professional development, program development, and articulation partnerships. That number is quite high given the program expectation that projects have a narrow focus. The lower level of success among the projects with four areas

of emphasis supports narrowing the focus a bit. We encourage limiting projects to three areas of emphasis at most, with clear priority given to one. Our findings suggest that strong success is usually in one area, and the added impetus may help projects plan better for success.

2. *More strongly encourage the ATE projects to conduct assessments of workforce needs*. One way to do this is to include needs assessments as part of evaluation expectations for projects. Including such needs assessments certainly can be accommodated without stressing the evaluation budgets of the projects (at least not beyond recommended NSF bounds). These assessments likely will strengthen the projects and the program as a whole, since timely knowledge of the local, regional, and national workforce needs will guide and inform project efforts across all program-related activity areas (e.g., materials development, program improvement).

3. *Encourage studies of recruitment and retention of female and minority students*. In this and previous reports we have consistently noted the difficulties in meeting the challenges of gender and ethnicity recruitment. This continues to be an area of program underachievement. We are not sure what additional steps should be taken. We encourage study (research) of this problem. Perhaps this is an area where collaborative relationships, an area of program strength, can be employed to improve results.

Notes on Sample Selection Criteria and Survey Structure

The selection criteria were (1) projects that were active for at least 1 year at the time of the survey or (2) new projects that were continuations of past NSF awards, and (3) projects that were active at the time the survey was administered. During the survey administration period, 5 projects were removed from the sample. Two projects were removed because we were notified their grants had expired prior to the survey period. One project was mistakenly included—it was a planning grant. One project was removed because its continuation grant was also in the sample—i.e., these awards overlapped by more than 1 year. One was removed at the request of NSF because its grant was mistakenly classified as an ATE grant, resulting in 158 ATE-funded projects, centers, and articulation partnerships, of which 4 (2.5%) never opened—completed—the survey. Ninety-seven percent (154) completed and submitted survey responses within the prescribed time frame (February-March 2004). Therefore, the final sample obtained for the 2004 survey was $N = 154$.

The 2004 survey contained seven sections, as opposed to the nine sections presented in previous years. Changes to the survey structure are listed below:

1. Combination of three program improvement sections—one for each education level served by the program—into one section.

2. Addition of a section dedicated to Articulation Agreement activities.

3. Removal of the Principal Investigator Overview (PI Overview) section.

The principal investigator for the project was asked to respond or assign another person(s) to respond for the grant. All grantees in the sample were asked to complete three sections: (1) Grantee Characteristics—confirming general information collected from other sources (e.g., name of principal investigator and the nature and duration of grant), (2) Organizational Practices—addressing efforts to monitor and evaluate the grant, and (3) Collaboration—addressing ongoing relationships that provide other forms of support to grantees.

Each grantee was then asked to complete one or more additional sections focusing on the primary categories of work that the ATE program supports: materials development, professional development, program improvement, and articulation agreements. 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 seven sections. The smallest and narrowest of projects would complete the three required sections and at least one additional section.