

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

**Survey 2002: The Status of
ATE Projects and Centers**

by

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November 2002

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Executive Summary

Survey 2002: The Status of ATE Projects and Centers

INTRODUCTION

This third annual survey¹ of *projects*² describes these *projects*' efforts and impacts and through them provides insights to the parent National Science Foundation's (NSF) Advanced Technological Education (ATE) program. When combined with other information³ and criteria, these annual descriptive findings and indices 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 GPRA⁴ reports and making programmatic decisions. ATE *projects* are likely to use survey results to learn about the activities and findings of other *projects* and to serve their own improvement needs.

Presently, ATE has approximately 200 active *projects*. Seventy-six *projects*⁵ (67 projects and 9 centers) that were active (i.e., were currently in their grant-funding period) for at least 1 year at the time of the survey in early February 2002 were asked to

¹The first survey was conducted in May 2000 (n=113) and the second in February 2001 (n=81). The substantially smaller 2001 sample number was due to a change in our sampling rule. In 2000, all current *projects*, except those that participated in the survey walk-through pilot process, were included in the sample. In 2001, only current *projects* that had been funded for a period of at least 12 months were included.

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

³See *Status Report 1* for descriptive information about the ATE program. See *Status Report 2* and the *Survey 2001 Report* for the 2000 and 2001 survey findings. See the issue papers for in-depth analyses based on the surveys and site visits and organized by topic (e.g., materials development). All these evaluation products may be found at <http://www.ate.wmich.edu>. Findings from the advisory committee study will be posted there in the near future.

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

⁵Fifty-eight percent of the current sample (44 of 76 *projects*) were also in the 2001 survey sample. Fifty-four percent of the current sample (41 of 76 *projects*) were in the samples for all three years of the survey (2000-2002).

participate. One hundred percent completed and submitted survey responses within the prescribed time frame (February 11-April 17, 2002). Findings based on the 76 responses received in 2002 and comparisons across the 3 years of the survey are presented in the Survey Findings section of this report.

In all three years, the survey form contained nine sections. All *projects* were required to complete three sections. Additionally, each *project* was asked to complete one or more additional sections focusing on the four primary categories of work that the ATE program supports: collaborations, materials development, professional development, and program improvement. Those that responded to the program improvement category were asked to complete a section for each educational level (secondary school, associate degree, and baccalaureate) where improvement efforts were targeted.

SURVEY FINDINGS

The summary of findings for the nature and scope of activity of the ATE program for the three years covered by the survey are presented first to provide context for the more narrowly focused work sections. How ATE is meeting its goals is summarized in Finding 1. Findings 2-5 are organized around the work categories of collaborations, materials development, program improvement, and professional development, respectively.

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

Nature and Scope of Activity

There is strong year-to-year consistency in the percent of *projects* engaged in the three target areas supported by the ATE program. These are materials development, professional development, and program improvement.

Percent of <i>Projects</i> Engaged in the Three Work Categories–2000-2002			
Work Category	2000	2001	2002
Materials Development	82	83	86
Professional Development	74	77	78
Program Improvement	63	67	67

Finding 1 (pp. 3-16). The *projects* have actively addressed the goals of the ATE program.

The following five general indicators were used for this determination. These indicators are based on ATE objectives as found in the *ATE Guidelines for Proposal Development*. Four of these indicators have been included in all three surveys—the fifth was new in the 2002 survey. On all four indicators previously used, the findings were positive in all years of the survey. Findings were also positive for the fifth indicator included this year.

Indicator 1. Projects engaged in work that is consistent with the expectations of the ATE program as set forth in NSF guidelines and the general mandate of Congress. In each year, more than 85 percent were engaged in at least 2 of 4 work categories. Around 70 percent of these *projects* were involved in at least 3 of the 4 work categories, reflecting the complexity of these *projects*.

Indicator 2. Six general health questions addressed outcomes-based factors for three of the four categories of *project* work in all three years⁶. In all years, the results were positive on these six factors; all responding *projects* were stable or increasing on the following factors (Tables 3 and 4, pp. 7-8):

- Collaborations—(1) financial support from other organizations and (2) participation by other institutions and organizations
- Materials Development—(3) use of *project*-developed products
- Program Improvement—(4) students enrolled; (5) students placed in related technical jobs, whether they completed program or not; and (6) students graduating or completing the program

Indicator 3. When respondents were asked to describe or indicate significant unintended outcomes (positive and/or negative) of their *project's* work, most responses given in all years were positive in nature (e.g., partnering/networking [82%], adaptation

⁶ Two questions addressing professional development outcomes were added in 2001 and retained in 2002, with positive findings.

of materials to other disciplines [51%], additional funding received [46%]—Table 7, p. 11).

Indicator 4. The large majority of *projects* gathered data to better direct their efforts. In each year, more than 80 percent reported employing evaluations to help guide their *projects* and/or ensure accountability of their efforts. Needs assessments and the involvement of advisory committees also played roles in evaluative efforts.⁷

Indicator 5. The large majority of the *projects* took steps to sustain⁸ or institutionalize *project* work and its accomplishments (see p. 16 for a list of these strategies). More than 80 percent reported taking one or more steps to sustain *project* work beyond the funding period. Nearly 80 percent identified one or more aspects of the *project* accomplishments that would be “institutionalized” (i.e., remain in their institutions after the *projects* end).

Finding 2 (pp. 16-22). The program encourages and achieves collaboration among educational institutions, with business and industry, and with other organizations to achieve the programmatic objectives.

In all years of the survey, the *projects* continued to establish many relationships that served multiple purposes and provided monetary and in-kind support for the programs. In each year, the typical (average) *project* maintained more than 15 separate collaborative efforts with business/industry or other organizations or institutions. Collaborative arrangements reported in the recent 2002 survey included more than 2,000 institutions and 3,800 individuals. These collaborations served materials development, program improvement, and professional development efforts in a variety of ways (e.g., advice, contributed time and effort beyond advice, and/or contributed or shared equipment/technology).

Across all three years *projects* have consistently (i.e., +/- 5%) rated the quality of their collaborations as good to excellent. On average, center ratings of collaboration have tended to be lower (satisfactory to good), though in 2002, the ratings from centers more closely approached those of projects.

The ATE program encourages and obtains substantial monetary and in-kind support contributions for development of STEM technicians. For example, those *projects* responding to survey 2002 that were engaged in collaborations indicated receiving more than \$5.3 million in monetary support and \$5.4 million of in-kind support in the last 12

⁷A separate study of advisory committees was undertaken late in 2001. Findings and recommendations will be posted to our Web site (<http://ate.wmich.edu>) in the near future.

⁸Please see the issue paper on Sustainability for additional analysis and recommendations (<http://ate.wmich.edu>).

months from non-NSF sources such as project/center institutions, business/industry, public agencies (local, state, federal), educational institutions, and other organizations. These two forms of support contributed an additional 19 percent to the resources provided by the ATE program.

Projects are also collaborating with other *projects*. In 2002, 57 of the 76 *projects* (75%) reported collaborating with other ATE *projects*, providing synergy across the ATE program. Collaborative activities included materials development (57%), professional development (53%), best practices development (39%), sharing of products (70%), and sharing of best practices (74%).

Finding 3 (pp. 22-30). The ATE program produces a large amount of materials that in turn serves program improvement and professional development needs.

In each of the survey years, the ATE program produced a large number of instructional materials including modules (e.g., laboratory exercises) that can be incorporated into coursework and full courses. Survey 2002 findings alone indicate that these materials serve technician development in at least 19 distinct fields (see Table 20, pp. 25-26).

Though the number of materials produced this past year is down from previous years, respondents reported more than 1,600 materials developed with more than 900 of these in use at least locally. The large majority of materials (80%) appeared to be oriented to the associate degree level, although *projects* reported that about 18 percent of the materials are targeted at the secondary level.

The program more heavily emphasizes matters of content validity than consequential validity. That is, for materials there is likely to be evidence of content validity; evidence that use of the materials leads to improved student learning is uncommon. Support for this conclusion includes:

In each year, more than 65 percent of the *projects* reported that they either obtained verification from industry regarding alignment of materials with workforce and skill needs or used applicable student and industry-based standards or guidelines to guide materials development.

In each year, more than 50 percent of the *projects* and 60 percent of the centers reported applying 1 or more of 3 identified student measures of success to validate their materials each time materials are developed.

More than 80 percent of *projects* reported that they pilot or field-tested within their own *projects* each time or most times.

About half of the *projects* reported conducting external field tests.

When asked to describe their most compelling evidence of quality for developed materials, the large majority indicated their reliance on reviews and statements of satisfaction by users rather than on concrete evidence based on collected data (e.g., student performance data).

In the 2002 survey, centers, more so than projects, plan to disseminate their materials beyond their *project* boundaries. Almost half of projects (n=57) and three-quarters of the centers (n=8) reported engaging in materials development for both program improvement and dissemination. That a higher percentage of centers viewed themselves as developing materials for these dual purposes is consistent with the centers' direction in the *ATE Program Guidelines* to provide materials to larger and more widely dispersed audiences.

Finding 4 (pp. 30-40). Associate degree institutions lead ATE's program improvement efforts. These improvement efforts have a broad reach—impacting large numbers of institutions and students and changing the structure and content of instruction on affected campuses.

In every year, approximately two-thirds of the *projects* reported involvement in program improvement efforts. In 2002, these efforts were reported as occurring in nearly 500 institutions/campuses and impacting over 30,000 students through more than 3,000 courses. On average, each *project* enrolled 138 and 624 persons in secondary and associate degree level courses, respectively.

Locus of changes. Nearly all program improvement efforts involved associate degree institutions (more than 90 percent in all years), with lesser numbers of secondary and baccalaureate institutions involved (approximately 30 percent-secondary; 6 percent-baccalaureate levels). Program improvement is most often focused on a single degree level (typically at the associate degree level) with only a third of the *projects* engaging in program development across degree levels. Cross-degree level programs occur chiefly between associate degree institutions and others.

Impact on courses. The program produces large changes in technical education programs through creation of new courses and changes to existing courses. Respondents were asked to identify a specific program at one location and provide detailed program improvement information for this program for the past 12 months. For these programs, *projects* reported that 70 percent of their course offerings were under development or modification in 2002 and 2001, a 16 percent increase over 2000.

Specifically, for survey 2002, new courses totaled 296, of which 19 were at the secondary level, 248 at the associate degree level, and 29 at the baccalaureate level. Changed courses totaled 298 (29-secondary; 241-associate; 28-baccalaureate). On average, a *project* created or developed 2 courses at the secondary level, 5 at the associate degree level, and 5 at the baccalaureate level. Since some of these *projects* have multilevel courses (e.g., associate and baccalaureate), some of the 296 new and 298 changed courses were reported by the *projects* at more than 1 degree level.

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

Student enrollments. Student enrollments were addressed at two levels—*project* wide and for a selected instructional program within a *project*. By both measures, large numbers of students were impacted by programmatic changes.

For *projects* as a whole, in 2002 the average *project* reported reaching 138, 624, and 98 students, respectively, at the secondary, associate, and baccalaureate degree levels in the past 12 months. While large, those numbers are significantly smaller than those reported in previous years. For 2000, for example, the comparable numbers for the 2 largest programs were 244 for secondary and 915 for associate degree levels.

Contrary to the trend for overall *project* findings above, student enrollment averages increased consistently over the 3 years for the within-*project* specified program conducted during the last 12 months. For the associate degree level, average enrollment increased from 94 in 2000 to 160 in 2001 to 173 in 2002. Representation of women and minorities held steady in all years. At the associate degree level institutions, around 30 percent of enrolled students were women, lower than a national 2000 study finding that 57 percent of all enrollees in community colleges were women (National Center for Education Statistics, 2001). However, STEM-type programs like ATE historically have a lower enrollment rate for women. For example, in 1996, only 19 percent of those enrolled in engineering programs at the undergraduate level were women (American Association of Engineering Societies, 1996). Similarly, about 32 percent of freshmen intending to major in science and engineering in 1996 were women (University of California, 1995). About 30 percent of ATE enrolled students were minority, similar to the finding of 33 percent reported by the National Center for Education Statistics (2001).

Degrees/certifications and transfer of credits. In all years, a large majority of the associate degree institutions provided either a technician degree or certification program; more than 40 percent provided both.

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

Recruitment, retention, and placement. Responses to new questions on the 2002 survey indicate that most *projects* give special attention to recruiting underrepresented groups (e.g., minorities, women, people with disabilities). Eighty-seven percent (66 of all 76 *projects*) reported using recruitment/retention strategies in general; 76 percent (58 of all 76 *projects*) reported using these strategies specifically to recruit/retain underrepresented groups. Table 29, page 37, illustrates that the strategies employed for general use and underrepresented groups were similar for a majority of the strategies. The most often reported strategies were the use of written materials, Web sites, college fairs, and campus visit programs. Tutoring, financial support, and counseling, which emerged from the first 2 years of the survey, were listed on the 2002 survey, but were not among the top 3 strategies employed.

This year's results show that more than two-thirds (69%) of the program's students who completed their secondary-school program plan to continue their STEM education, similar to another national study of high school graduates (Bureau of Labor Statistics, 2002–62 percent were enrolled in college the following fall)⁹. At almost the same rate (67%), completers of programs at associate degree institutions plan to take technician positions. This proportion for associate degree institutions is much higher than that reported in 2001 (46%) but comparable to that reported in 2000 (73%). The proportion at associate degree institutions who completed the ATE program but continued their education remained around 30 percent in all years. Similarly, the Bureau of Labor Statistics (1992) reported that about 30 percent of students who complete 2-year programs continue on to 4-year schools. For the 2002 Survey, *projects* continued to identify various activities to assist with placement.

Finding 5 (pp. 40-45). *Projects* have conducted large numbers of professional development activities for faculty and staff.

These activities are well attended and well received. However, studies of impact to determine whether these activities cause or direct change or whether changes, when they occur, yield positive results, appear to be rare.

Types of offerings. In 2000-2002, conferences, workshops, and in-service courses remained the most popular modes for professional development. While the number of *projects* reporting remained relatively constant in the 3 years of the survey, the reported number of these large offerings increased to 579 from 475 in 2001 (648 in 2000). The number of conferences and in-service courses remained relatively constant at around 100 each, with workshops accounting for most of the fluctuation across the years.

⁹Among the 2.5 million members of the 2001 high school graduating class, 62 percent were enrolled in college the following October (Bureau of Labor Statistics, 2002).

Participation. Professional development opportunities continued to attract many participants and were well attended and received. In all years, the median large course offering size was approximately 20 for projects and about 130 for centers. Most participants were from associate degree granting institutions (medians of 14 from projects, 100 from centers), followed by secondary faculty (medians of 10 from projects, 30 from centers). Regarding how well attended their professional development opportunities were in both years, more than two thirds of the *projects* reported they were at least at 75-100 percent of full capacity.

Satisfaction, follow-up, and implementation. Over the three years of the survey, *projects'* professional development participants reported high levels of satisfaction with the professional development opportunities. While similarly positive findings were reported for trial and incorporation of technology, materials, and/or major ideas, the response rate on those items was too low to attribute the findings as credible. Less than a majority of the *projects* reported whether professional development participants tried-out materials, and fewer than a third of projects reported on whether these participants reported incorporating what they learned into their classrooms.

Low response rates on matters of follow up led to a new question in 2002. From that item we learned that 75 percent follow up with participants in one or more ways. Most often they survey participants (73%). As suggested above, they must typically query participants about satisfaction rather than matters of implementation. Other forms of follow up include letters or email (70%), personal contacts by phone or in person (54%), and newsletters (32%).

Most *projects* reported providing support to their participants in all survey years and consistency in types of support provided, which included technical assistance, materials, and financial support. In each year, fewer than half the *projects* reported asking participants' local institutions for support.

STRENGTHS AND SUGGESTED IMPROVEMENTS

While largely descriptive, the survey's five primary findings suggest *projects* are strong and highly productive. These five findings appear to coalesce into three main strengths and one suggested area of improvement:

1. The programmatic mission of ATE is clearly evident in the work of its *projects*. That is, the *projects* actively addressed the goals of ATE's mission as stated in the *ATE Program Guidelines* and other supporting documents.

As the data show, the program gives most emphasis to materials development, slightly less to professional development, and even less to program improvement in terms of numbers of *projects* engaged in each of these areas. Those emphases are consistent with the program's logic. That is, most materials development efforts serve either

professional development, program improvement, or both. Similarly, program improvement efforts also routinely entail professional development to improve faculty and staff skills to teach new content or to teach content in new ways. In each area work of the *projects* is consistent with *ATE Program Guidelines*.

2. The program achieves substantial productivity in materials development, program improvement, and professional development; strong collaborative efforts by *projects* serve that productivity.

By a variety of measures across the program (e.g., number of collaborative efforts, the number of materials developed, students reached or graduated, number of professional development opportunities), the program consistently has a large impact. This productivity is fully consistent with the *ATE Program Guidelines* and NSF and Congressional expectations that provide the impetus for the program.

3. The ATE program is likely to produce favorable residual effects (i.e., effects that last beyond the period of funding) at the funded institutions.

The probability of such effects is apparent in several indicators. First, the large majority of *projects* are taking one or more steps to institutionalize aspects of their *projects* (e.g., programs, courses, materials, collaborative arrangements with other educational institutions and with business and industry). Second, professional development activities are well received, and ideas gained through those efforts seem likely to persist and affect future instruction and learning. Third, the large number of collaborations suggests that networking among professionals vested in improving technological education is occurring. Tracing actual events (e.g., postfunding outcomes) and documenting changes (e.g., number of articulation agreements completed) could provide more concrete bases for this judgment.

4. The ATE program focuses much more directly on product development than on quality assurance (validation). The findings from this and previous years consistently show that most *projects* do not substantiate their products and services (e.g., professional development activities) through strong evidential procedures¹⁰. Because the discrepancy persists, today it is a bigger worry than it was two years ago.

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

We encourage the ATE program to both strengthen its program guidelines by calling for stronger validation evidence and to support and assist *projects* in designing effective procedures and evaluations to obtain such evidence.

For example:

Projects can and should conduct stronger external field tests of their products.
Projects can and should tailor their professional development follow-up activities to more often include the assessment of implementation of ideas and materials at the local level (Willingness to participate in and provide such information could be a requisite for participation in the professional development activity).

Additionally, we suggest that the ATE program alert the National Visiting Committees to look for and address these issues when they occur at the *project* level.

Finally, we note that the ATE program's annual principal investigators' meeting in 2002 will focus on evaluation and assessment practices. That attention appears to be an important step in the right direction and hopefully will produce better practices among funded *projects*.