COLLABORATION EFFORTS FOR THE ATE PROGRAM

ATE CENTERS' AND PROJECTS' APPROACHES, USE, AND EFFECTIVENESS OF COLLABORATION

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[2] Edited by the WMU Evaluation Project, January 2002.

Executive Summary

Collaboration Efforts for the ATE Program

ATE Centers' and Projects' Approaches, Use, and Effectiveness of Collaboration

The use of collaborative arrangements by *projects* (i.e., projects and centers) funded by the National Science Foundation's (NSF) Advanced Technological Education (ATE) program is an expected method of achieving project goals of improving the U.S.'s technical workforce. In keeping with this expectation, this paper developed a definition of *collaboration* and created a set of elements that enhanced collaborative success in reaching ATE project goals.

> *Collaboration is a sustained formal partnership fostered by ATE projects and centers between K-12 schools, community colleges, four-year colleges and universities, businesses, government agencies, and professional societies in order to respond to the educational needs of the workforce by facilitating the achievement of the project's/center's objectives and which results in mutual benefit to all participants.*

Using this definition and elements as a guide, the paper presents a review of *project* use and the effectiveness of collaborative arrangements. As a result of the review, the paper concludes:

Based on those data contained in the WMU evaluation project surveys and site visits, it is clear that ATE *projects* are using collaborations effectively. The overall positive impact of these collaborative arrangements on ATE's efforts to create advanced technological education is significant. Although some adjustments can improve the collaborative effort, clearly the objective of partnering educational deliverers and business/industry to produce a world-class workforce is a strong point of the ATE program. The following specific conclusions seem reasonable concerning ATE *projects'* use of collaboration:

- The use of collaborative arrangements by *projects*, especially community-college-based *projects*, is widespread and a fundamental characteristic of the organizational entities involved in leadership roles.

- The ATE *projects* initiated the collaborative arrangements.

- The collaborative efforts included appropriate members for the intended outcomes.

- The greatest numbers of *project* collaborations were formed around business/industry, K-12 (primarily secondary) schools, and community and/or four-year colleges.

- Most collaboration with business and industry seemed to focus on workplace standards development and work-based educational experiences.

- Business and industry were not normally involved in verifying the validity of newly developed curriculum products.

- All reported collaborations focused on the *projects'* goals, objectives, and desired outcomes. The degree that these were shared with partners varied; but in general, there was an adequate awareness of the ATE *projects'* focuses.

- The reported data did not indicate that a clearly defined "mutual benefit" to *project* collaborators had been routinely established. This was particularly true in collaborations with business and industry and with K-12 schools.

- The reported collaborations varied widely in duration and formalization. The range was from short, ad-hoc relationships of a few days to long-term, sustained relationships based on formal agreements.

- Since those data gathered were from currently active *projects*, there is no way to judge the persistence of the collaborations after grant funding.

Based on these conclusions, the paper contains a series of recommendation for the ATE program:

1. *Project* proposals should clearly identify the expected collaborations to include types of membership, duration, purposes, and expected outcomes.

2. ATE should continue to encourage statewide, regional, or national consortia as part of the collaboration model for large *project* awards.

3. ATE should continue to actively facilitate center-to-project collaboration and, where similar outcomes are identified, project-to-project collaboration.

4. For *projects* involving development of technical curriculum products, business and industry involvement in verification of product effectiveness should be required.

5. ATE should provide guidance on "best practices" for sustaining collaborations beyond *project* funding and systematically gather data concerning collaboration sustainability.

The paper also includes recommendations for ATE *projects* on the effective use of collaboration and a set of queries to guide evaluation of collaborative arrangements.

COLLABORATION EFFORTS

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The Paper's Intended Audience

This paper addresses the use of collaboration as part of the National Science Foundation's (NSF) ATE program[3] and is primarily intended for use by the ATE staff. It contains information and recommendations that may also benefit funded ATE *projects*[4]. For these *projects*, a schema for evaluating collaboration efforts is also included. Additionally, organizations or individuals seeking ATE funding that involves creating effective collaborative arrangements may find the paper useful in developing their proposals. Finally, members of the Congressional staff involved with ATE funding may gain some insight from the paper in terms of the current state of ATE collaborations.

The Origins of ATE Collaborations

The ATE program is NSF's response to the *Scientific and Advanced – Technology Act of 1992 (PL 102-476).* In creating the Act, Congress stated a belief that the issue of under-preparedness could best be addressed by ***collaboration among the nation's associate-degree-granting colleges and private industry*** and concluded that NSF's role in ***stimulating partnerships between educational institutions and industry*** made an enlarged role in scientific and technician education particularly appropriate[5]. *(Bolding added)*

By establishing key goals of *collaboration* and *partnerships*, Congress is clearly calling for a joint effort involving education deliverers and industry in NSF-ATE funded programs. Equally apparent is the focus on associate-degree-granting colleges as the initiator of these supportive arrangements. ATE award guidance states that *projects* should include "two-year colleges in leadership roles."[6] This stipulation remains consistent in award guidance for 1997 through 2002.[7]

This paper addresses the concept and results of collaboration and partnerships in funded ATE centers and projects. Centers are a major effort by a funded entity spanning multiple years, whereas projects are more limited in their objectives.

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[3] Please see the attached overview document (*The ATE Program: Issues for Consideration)* accompanying this paper for a detailed description of this program and its evaluation.

[4] This paper will follow The Evaluation Center's convention that *project* in italics is used to denote ATE funded projects and centers.

[5] *Status Report 1: The Nature of the ATE Program,* p. 2, Table 1, Kalamazoo, Michigan: The Evaluation Center, Western Michigan University. May 2000.

[6] *Advanced Technological Education, Program Announcement 97-29*, NSF Web site www.ehr.nsf.gov/EHR/DUE as of March 27, 2001, pp. 2-4.

[7] Reflected in NSF program application guidance: *ATE Program Announcement*, 1998, *ATE Program Solicitation* 2000 & 2001. Other references to the 1997 guidance contained in citation 4 above are also reflected in these later documents.

Defining Collaboration

An operational working definition of *collaboration* is needed as a starting place in reviewing the degree of success ATE-funded *projects* are having in meeting the goal of collaboration and partnerships set by Congress. Three primary sources can contribute to this definition: existing literature on the topic[8], the definition formed by a review of NSF-ATE program guidance and solicitation documents, and the definition developed by The Evaluation Center as part of its evaluation of the ATE program.[9] Although the term *collaboration* is primarily used in this paper, it includes the concept of *partnerships* that is commonly used in educational literature when referring to mutually beneficial and supportive relationships[10].

The review of literature focused on collaborations in an educational setting. Other than dictionary definitions, educational literature generally describes the need for and intended results of collaboration and/or partnerships but, with some exception, rarely discusses the dynamics of such a relationship.

A somewhat typical approach to collaboration in literature is to list the expected behaviors of specific partners. An example is the list provided for partnerships to the improving science, technology, engineering, and mathematics (STEM) education. This list contains 22 actions such as *Provide funding for technology* and *Provide state-of-the-art equipment to local colleges and universities.*[11]

The *Scientific and Advanced Technology Act of 1992* also assumes that the concept of collaboration between private industry and other entities and the community colleges[12] is clearly understood. This seems to be a safe assumption for technical education programs. A review of literature addressing community college educational programs points to the fact that collaborative relationships between community colleges and external and internal entities are essential in career or technical programs. Also evident is that a link between the community college and employers has been a staple of workforce development programs since they were first introduced in the 1950s.[13]

Typically, community colleges report that the nature of technical programs requires partnerships with business and industry. For example, Madison Area Technical College (MATC), Wisconsin, reports, "The concept of partnerships evokes a variety of models used

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[8] Literature was selected based on Internet and university library searches. Selected items focused on collaboration and partnerships in an educational setting.

[9] The Evaluation Center at Western Michigan University has been designated by NSF to evaluate the degree of goal achievement, impact in reaching intended individuals and groups, effectiveness in reaching constituents, and recommendation on possible significant improvement.

[10] Upon review of this paper, NSF suggested a hierarchy of contact, collaboration, and partnership. Contact is making a presentation or getting funding. A collaboration is working on a joint endeavor for a short time with out many agreements. A partnership is a longer-term relationship with definite expectations on both sides.

[11] James R. Mahoney, ed., *Improving Science, Mathematics, Engineering, and Technology Instruction, Strategies for the Community College*, 32-4, Washington D C: Community College Press 1996.

[12] As a matter of convenience the term *community college* will be used in this paper when referring to associate-degree-granting colleges.

[13] Charles R. Monroe, *Profile of the Community College*. San Francisco: Jossey – Bass Publishers 1973 78-87.

by academic institutions to build and maintain interactions with business and industry."[14] In describing the technical program partnerships, MATC states, "The curriculum and equipment needs of the programs were defined through input of business and industry partners."[15] However, there is no discussion of the components or dynamics of the collaboration engendered by these college/business partnerships.

ATE guidelines point to the need for *projects* to form formal and sustained multiple cooperative arrangements supporting a variety of outcomes. For example, ATE materials refer to *projects* "establishing partnerships among high schools, businesses, government agencies, and professional societies in order to respond to educational needs of the workforce."[16] ATE documents also include expectations that its programs "promote exemplary improvement in technical education at national and regional levels by supporting—particularly in two-year colleges and secondary schools—the design and implementation of new curricula, courses, laboratories, instructional materials, opportunities for faculty and teacher development, academic support for students, and formal cooperative arrangements among educational institutions and partners from business, industry, and government."[17] The program announcement further states that these alliances should exist "both during the *project* and on an ongoing basis after its completion."[18] Although clearly an expectation, guidance as to how to arrange and nurture the referenced "partnerships," "cooperative arrangements," and "alliances" is not provided by ATE.

This theme of multiple collaborative arrangements is further expanded in *The Learning Edge*[19] that states, "*projects* should be built on alliances of associate degree granting institutions with four-year colleges and universities, secondary schools, business, industry, and government."

A final source of input into this paper's operational working definition of collaboration is the definition offered by The Evaluation Center in its review of components driving successful accomplishment of funded *projects.* The Center's definition states "*collaboration is the relationship of projects and centers with businesses, industries, educational institutions, and other organizations to achieve project/center objectives*."[20]

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[14] "Interdependence Through Partnerships: Transforming Education," *Improving Science, Mathematics, Engineering, and Technology Instruction, Strategies for the Community College, 64*, Washington DC: Community College Press 1996.
[15] Ibid. p. 65.
[16] "Advancing Technological Education", *Synergy*, p. 4, Arlington, VA, National Science Foundation March 1999.
[17] "1997 Awards and Activities", *Advanced Technological Education* p. 1, Arlington, VA, National Science Foundation 1997.
[18] *Advanced Technological Education, Program Announcement 97-29*, ATE, p.2-3.
[19] James R. Mahoney, Lynn Barnett, eds., *The Learning Edge, Advance Technology Education Programs at Community Colleges*, 7-14, Washington DC: Community College Press, 2000.
[20] ATE Site Visit Report Outline, *ATE Drivers,* The Evaluation Center, Western Michigan University. Kalamazoo, Michigan, Distributed September 2000.

Collaboration defined. The definitional construct used in this paper is: *Collaboration is a sustained formal partnership fostered by ATE projects and centers between K-12 schools, community colleges, four-year colleges and universities, businesses, government agencies, and professional societies in order to respond to the educational needs of the workforce by facilitating the achievement of the project's/center's objectives and which results in mutual benefit to all participants.*

Collaborations in technical education. ATE is essentially engaged in technical education with a preponderance of the effort focused at the community college level. However, even without the influence of ATE funding, all community college technical programs are, by necessity, engaged in collaborations. The nature of the curriculum demands association with product users—businesses and industries that hire graduates. Such associations may be from ad hoc gatherings for a limited purpose (such as defining standards) to standing committees that persist through the life of the program. For example, technical programs customarily have advisory committees that include business and industry representatives. In fact, such "lay advisory committees" for technical degree programs is a community college system mandated requirement in almost all states. Dependent on local requirements, these committees meet to assist programs from as frequently as quarterly to only once annually. Career and vocational programs at the secondary school level also use similar advisory committees.

Consortia of two-year colleges exist in almost all systems to provide coordinated educational programs. And, for programs that have articulation with four-year programs as a goal, there are collaborative arrangements with the senior institutions. Often, program directors and technical faculty are members of institutional teams addressing recruitment and student development services. These same individuals often work with K-12 schools to foster approaches that lead students to enter their technical programs.

What is different is that ATE *projects* are expected to expand and raise collaborations to a higher level of success. Collaboration, particularly with business/industry, K-12 programs, and other two-and four-year educational institutions, is a major pillar on which ATE material and program development rest. Collaboration for ATE *projects* is not a secondary effort, but a major supporting activity vital to quality technical education. ATE-assisted technical education efforts are expected to be successful, due in great part to the use of effective collaboration.

Key collaborative areas. Technical workforce development efforts that require sustained collaborations with business and industry include areas such as skill/standards development, curriculum review, providing work-based education experiences, and program pilot and field-testing. Pilot and field-testing of curriculum are often thought of only in the context of activities conducted by members of the academic community. However, business and industry participation in these activities is essential in technical education programs. The issue for business and industry is the verification of curriculum meeting the intended outcomes of developing workplace knowledge and skills. The academic community engaged in technical education can design and collect pilot or field-test data that reflect on the efficacy of the educational process. But the final question of *"Does it produce advanced*

technicians for the workforce?" is one that must be answered by those who hire the technicians.

A special benefit of meaningful collaboration between business and industry and *projects* is credibility. If the employers are part of the process of designing, providing, and evaluating workforce programs (or materials used in such efforts), they are more likely to hire the individuals educated in the ATE *projects.* The business and industry members of a standards development team may not have responsibility for hiring; however, the fact that their contribution is part of the basis of a technical program provides the academic institution leverage in the placement of program completers. Assuming that the technicians emerging from the improved programs are better prepared, then the productivity of the American workforce will be enhanced. The transferability and dissemination of products from ATE *projects* will also be enhanced if they are supported by the businesses and industries employing individuals who were educated using ATE-generated products. Also, these collaborations often serve to expand the resources of the *projects*, particularly in areas of equipment, software, and other industry-specific educational needs.

Two other areas that are collaboration-dependent are the articulation of programs and the K-12/community college connection. Articulation (the movement of a student's educational experience between educational entities) depends on the willingness of the receiving institutions to accept the transferring student's educational competencies as equivalent to those provided by the receiving institution. Continuing collaboration on the content/outcomes of courses between secondary to associate degree and associate to baccalaureate degree institutions is essential for viable articulation agreements.

The K-12/community college connection is another area where sustained dialog and mutual effort is essential to ATE's success. The major areas of this effort are teacher enhancement and recruiting of students. Improvement in student readiness in science, mathematics, engineering, and technology (SMET) is a major ATE objective. Community college and K-12 collaboration on increasing teacher development, particularly in technology, provides a "win- win" situation for the K-12 school system and the community college. The result of this effort is to provide better-prepared students for advanced technician programs at the community college.

State of ATE Projects Use of Collaboration

This section of the paper is oriented to the current state of collaboration in funded ATE *projects.* The sources for the data presented are listed below:

- A detailed review of The Evaluation Center's report of *Findings from a Survey of ATE Projects and Centers* (a Year 2000 report and draft of the Year 2001 report)[21]

- A review and comparison of factors discussed in site visit reports[22] from visits to selected ATE *projects*

[21] Data highlighted in this paper are from the 2000 survey report. If there are significant difference between the 2000 and 2001 data, these differences are referenced either in the body of the text or in an appropriate footnote.

As a departure for measuring ATE *project* collaboration, The Evaluation Center's report of *Findings From a Survey of ATE Projects and Centers* provides a measure of the *projects'* self-reported collaboration arrangements. In the Executive Summary of the Year 2000 report,[23] Finding 2 states, "ATE *projects* have established a large number of collaborative arrangements. The collaborations serve multiple purposes and provide monetary support as well as other kinds of assistance for materials development, academic programs, and professional development efforts."[24] A similar finding was presented based on the 2001 survey data. The finding goes on to state that overall *project* efforts have yielded more than 15,000 collaborations (over 13,000 in 2001 survey). However, the nature of aggregated findings limit analysis in terms of *projects* achieving meaningful relationships in line with Congressional and NSF ATE expectations.

The 2000 and 2001 survey reports do caution that *projects* might have reported a single collaboration in multiple categories, resulting in the large totals. After applying an adjustment for the maximum in the data, the report authors estimate that in 2001 there would still be more than 900 collaborations—nearly 16 per *project*. Also, all 13 *projects* at which site visits were conducted had numerous collaborative arrangements. Regardless of the exact number of collaborative arrangements, ATE *projects* clearly are collaborating with others as they pursue their goals.

Collaborations reported in the survey were with a variety of institutions and organizations (e.g. business/industry, secondary education, associate and baccalaureate degree institutions, and professional associations) and for multiple purposes (e.g. professional development, materials development, and advisory). Of the reported collaborations, *projects* identified direct or in-kind funding as the nature of the relationship in terms of dollars received as a result of the collaboration. Direct contributions of money from non-NSF sources remained relatively constant (around $12-$14 million) in both survey years. In each year, *projects* reported leveraging NSF's funds with additional monetary and in-kind contributions from non-NSF sources. For every dollar provided by NSF for the duration of the *projects'* grant periods, the *projects* reported increasing their working resources for the ATE program by 50 cents in 2000 and by 80 cents in 2001.[25] ATE *projects* are clearly successful in leveraging their grant dollars to attract significant additional resources through the collaborative process.

The survey categorized collaborations by four types of organizations and purpose. The greatest numbers of collaborations were with business/industry (nearly 85 percent for projects and 100 percent for centers in 2001). Collaboration rates with other organizations identified in the survey ranged from about 50 to 65 percent for projects and 75 to 100 percent for centers. The one exception was the catchall category of "other." With the comprehensive list of identified organizational types in the survey, a limited number of "collaboration with others" seems appropriate. Considering the emphasis on technical education, this distribution

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[22] Site visit reports are comprehensive documents created by members of The Evaluation Center's "visiting teams" that did on-site reviews of ATE projects at 13 locations. These reports have limited distribution to preserve the anonymity of the sites visited. Therefore, no citations will be provided when referring to information contained in these reports.

[23] *Status Report 2: Findings From a Survey of ATE Projects and Centers,* p iv.

[24] Ibid., iv.

[25] *Survey 2001: The Status of ATE Projects and Centers,* p. 48.

reported in the survey is in line with the author's expectations and reflects a comprehensive approach to collaboration by ATE *projects.*

In terms of the collaborative purpose, data are presented as a percentage of the *projects* having collaborations in areas of general support (advice, shared equipment, etc.); materials development (developing standards, pilot and/or field-testing materials, etc.); professional development (e.g., providing knowledge of industry needs, developing faculty knowledge and skills, etc.); and program improvement/academic programs (e.g. work-based instruction, student recruitment, student understanding of industry requirements, etc.). These data show a relatively high percentage of collaborative support from business/industry and educational institutions in all categories. This distribution reflects ATE *project* engagement in collaborations over a large landscape of potential purposes.

In site visit reports, the identified collaborations were similar to that reported in the survey data and were primarily with educational entities (K-12 schools, community colleges, and baccalaureate degree colleges) and businesses and industries. In most cases, the *projects* developing instructional materials or creating improved technician programs were housed at community colleges. The type and scope of collaborations in the associate degree colleges varied in length of the relationship, purpose of the collaboration, and degree of involvement by participants.

A significant group of collaborations cited in site visit reports were short-term (even single encounter) relationships. Meetings with local business/industry representatives to identify workplace competencies most often reflected this limited, one-time characteristic. Regardless of their length, business/industry collaborations were, however, critical to the success of the *project* by providing needed advice; access to equipment; and in some instances, funding. The reports provided some examples of longer term collaborations with business/industry, such as advisory committees and developing and providing student internships that also were essential to improved technical education. The site visit interviews with collaborative business/industry representatives reflected their respect for the *projects*' efforts, and industry involvement clearly increased the credibility of the *projects'* product(s).

An interesting data element from the survey is the reported low participation of business/industry in pilot and field-testing of materials. Three of 11 centers and six of 46 projects[26] reported pilot/field-testing as the nature of their collaborations with business/industry. Most centers and nearly half of the projects reported support for pilot and/or field-testing by educational institutions. This may signal a need to strengthen this relationship between business/industry and *projects* in verifying curriculum products (see page 6 for further information on this issue).

The ATE *projects* reported that the quality and productivity of their collaborations ranged from satisfactory to excellent. Centers reported a lower degree of quality and productivity than did projects. Since the number of collaborations managed by each center is larger than those of each project, the greater number of relationships that are less productive or of lesser

[26] 2001 data. 2000 data showed a lower participation.

quality at centers could reasonably be anticipated [27]. Comments in site visit reports generally rate collaborations as meaningful and productive.

The survey collected data on factors that ATE *projects* identified as significant in enhancing or creating productive collaborations. Respondents identified factors such as mutual benefit to collaboration participants, a clear statement of goals, defined roles of partners, established communication channels, building trust, fostering group understanding of goals, and achieving a zone of comfort among team members.

Barriers to productive collaborations focused on two major areas—lack of resources and time factors. Reported resource constraints affecting collaborators are a lack of top-level school and college administrative interest or support. In general, all *project* levels cited the following items as "resource barriers": (1) misunderstanding of the "*project* idea" (or purpose or goal); (2) entrenchment—especially in higher education; (3) overstating goals in underfunded grants; and (4) competing requirements for limited resources. Lack of time by collaboration academic partners to create or review curricular materials and the inability of business partners to "miss work" were time factors cited as barriers. Although time was the most cited reason for collaboration failure, the interaction of time with other factors, such as clarity of purpose that establishes a high priority for collaborative effort, might signal that "lack of time" serves as a surrogate for "lack of interest" or other factors that need fixing to insure success. [28]

Project leaders' collaborations with K-12 school systems were generally at the secondary level and varied from providing materials, making presentations to students and, in some cases, working toward secondary to postsecondary articulations. *Project* participants also developed and presented workshops in cooperation with school districts and schools. The description of these relationships revealed that they often were heavily reliant on *projects* "providing services" and "initiating contact" with schools and not based on a concept of shared effort and purpose. The secondary/postsecondary relationship seems to be motivated by attracting students to enroll in the *project's* program. In this regard, the reported K-12-community college relationship focused on improving technician education, since the associate degree is the main vehicle for that improvement. The efforts of *projects* to increase K-12 teacher preparation for the understanding of and opportunities available in technical education fits well with the ATE initiative. However, these efforts often existed before the NSF ATE grant, but seemed to be enhanced by the infusion of grant funds. The activity level in these secondary/postsecondary collaborations after the funds are exhausted remains to be seen.

With almost no exception, community college collaborations with institutions having four-year programs in disciplines related to the *project's* educational program were for articulation. These relationships, although sometimes characterized as receiving advice on program content and/or verifying appropriate course content by senior colleges, were for the purpose of aligning course content for acceptance as part of a student's four-year program. Achieving the maximum degree possible in educational continuum "seamlessness" is a goal

[27] Ibid., 20.
[28] Ibid., 21-22.

of the ATE program and is being well supported by the *projects.* Based on reported site visit data and discussions with *project* staff by the author during such visits, the characteristics of these collaborations:

- are individually oriented toward a specific senior college and discipline
- persist once an agreement is reached and formally executed
- are normally initiated and pursued by the associate degree institution (although in some reported cases, the senior institution's need for increased enrollment resulted in it being an aggressive versus a reluctant partner)
- once the agreement is reached, is a need for periodic recontact by the *project* institution to ensure a continuing, beneficial implementation of the agreement

In some reported collaborations, agreements on dual enrollment and shared tuition between associate and baccalaureate institutions have moved traditional articulation to a new level. In general, the associate degree institution's effort to achieve articulation of its technical programs predates ATE. However, as is the case with the secondary and postsecondary collaborations, ATE resources have had an impact. Funding from ATE to improve programs has served as a stimulus for acceptance of credits by senior colleges. In the future, pursuit of collaborations to create articulation agreements will persist even without ATE's additional funding. But, as evidenced by the reported newly negotiated articulation agreements, ATE influence in creating more rigorous technical programs at community colleges has created a more willing environment for mutually beneficial collaborations.

A collaboration between projects with similar objectives and, more likely, between centers and projects would seem natural for the ATE program. However, the site visit reports make reference to only one such collaboration

Findings Based on the State of Collaboration

Presented below are some generalized findings based on data gathered from the surveys and visits to ATE *projects.*

Effectiveness of project collaboration. How do the data on reported ATE *project* collaborations stackup against the definition offered in this paper? An overall answer would be "very good." As a reminder, the proffered definition follows:

> *Collaboration is a sustained formal partnership fostered by ATE projects and centers between K-12 schools, community colleges, four-year colleges and universities, businesses, government agencies, and professional societies in order to respond to the educational needs of the workforce by facilitating the achievement of the project's/center's objectives and which results in mutual benefit to all participants.*

A summary of ATE collaborations compared to the definitional elements is presented below:

- *The collaborative relationship is to be initiated, facilitated, and sustained by the ATE project*.

All collaborations were initiated by ATE *projects*, even if they existed before ATE funding. The need to focus on an issue, in some instances, arose outside of the *project* organization, but the *project* organization assumed responsibility for creating collaborations needed to resolve the issue. Those *projects* that produced positive results were guided and managed by *project* personnel. Collaborations generally atrophied without active leadership by *projects*, and collaborations with a limited purpose also had a limited life. In particular, collaborations involving business and industry in developing workplace standards were reported to be active early in the *project's* life. However, they did not always evolve into a continuing, mutually supportive relationship during curriculum development, testing, and implementation.

- *The purpose of the collaboration is to support objectives of the ATE project and should be formally defined by the parties concerned.*

The trigger for all reported collaboration was the support of *project* objectives. In some cases, the linkage to NSF-ATE support of these objectives was not made clear to collaborators. In one report, the comment was made that " it appeared that NSF support was the silent or invisible partner in many of the programs described." Based on site visit reports, the foundation of the most successful and sustainable collaborations was a formal understanding of purpose, membership and expected contributions, procedures, and identification of expected results. Although not specifically discussed in these reports, it can be deduced that formalization was the exception, not the rule. Consortiums with shared grant funding were most likely to have a more formal structure.

- *Although short lived and/or serendipitous relationships can benefit goal achievement, the collaboration envisioned by Congress and NSF-ATE is a sustained systemic effort during and after ATE funding.*

The strongest collaborations were characterized by the routine and regular meetings of the parties involved. These contacts appear necessary to sustain enthusiasm and progress toward stated goals. Although it could be assumed that collaborations for articulation with four-year programs and secondary school contacts associated with recruiting would continue, the postgrant level of activity is not known. This is due in part to the evaluation structure that examined only currently funded *projects.* Anecdotal data in several site visit reports point to the fact that collaborative efforts between resource partners did not remain strong after *projects* ended funding for the activity.

- *Participants in collaboration include all who have a stake in the outcome of creating a world-class workforce. The following major players are included:*

  - *K-12 schools as feeders into community colleges*

    This clearly was one of the major roles undertaken by *project* leaders, particularly in the community-college-based *projects.*

  - *Community colleges that produce the advanced technicians*

    Consortiums of community colleges are a major feature of many *projects.* These national, regional, and statewide consortiums based on supportive associate degree programs appear to be the strongest component in the ATE *project* matrix.

  - *Four-year colleges that provide advanced educational opportunities for associate degree technicians*

    Associate degree colleges invariably pursue program articulation with baccalaureate programs for their technical degrees. The support of ATE appears to increase the success of achieving articulation.

  - *Government and governance entities that control and facilitate the educational processes*

    Statewide initiatives tend to create coalitions that involve state agencies in the task of approving and creating acceptance for ATE *projects'* efforts. This support appears to be beneficial in terms of moving toward the goal of a wider acceptance of the *project's* products by state system community colleges.

  - *Private and public businesses and industries that employ the technicians*

    All ATE *projects* that took part in the site visits had multiple collaborative arrangements with employers in the private and public sectors. Based on both survey data and site visit reports, the relationships seemed to be directed toward limited purposes (e.g., standards development, development of student work-based educational experiences, equipment and/or funding support, etc.). Many collaborations were of relatively short duration, such as calling together representatives to assist in identifying workplace competencies. There were longer relationships, particularly in terms of lay advisory committees for specific technical programs. These relationships exist as long as the educational program exists regardless of supplemental ATE funding. Implicit in the site visit reports is the fact that wider based *projects* (national, regional, or statewide) have a more formal enduring relationship with business/industry. Based on site visit and survey data, business/industry was not significantly involved in verifying the efficacy of *project* materials by participating in pilot or field-testing.

- ❖ *Professional organizations that support elements of educational improvement*

  Program accreditation by professional organizations was sought and gained by some of the ATE programs. Based on reported data, most programs in information technology sought and received industry certification.

- ➢ *Partners in collaboration must have a recognizable stake in the effort's outcomes. Collaborative results that meet partner needs should be clearly identified.*

Collaborations clearly support the goals of the ATE *projects.* There are numerous examples where the mutually beneficial relationship between partners was clearly understood. This is particularly true when business and industry had a critical need for skilled technicians and in associate degree/baccalaureate degree articulations. Reports also indicate that both parties in K-12/community college relationships that provide teacher professional development actively embrace *project* goals. However, it is not clear from the available data that all partners in collaborations had their stakes in the effort clearly identified. In one reported relationship between a large urban and a smaller rural community college, the larger college appeared to view the collaboration as of little or no benefit and only marginally pursued the stated common goals. Also, the goal of instituting changes to K-12 school curriculum (both in increasing math/science rigor and integrating technology topics) appears to be less productive for a variety of reasons that are beyond the control of the ATE *project* leaders.

Collaboration models for expanding project impact. The primary focus of the ATE program is the improvement of the U.S. workforce, not just a local workforce. This presents a challenge since, with some exceptions, the community college is the ATE grantee for *projects,* and community colleges are just that—community based. This community orientation may restrict the reach of the community college to its geographical service area.[29] The issue is "How do these traditionally locally focused institutions expand their influence beyond their traditional geographical and constituent boundaries?" Collaboration with other community colleges is the best answer. Other activities, such as materials clearinghouses, conferences, workshops, and presentations at meetings, can contribute. But, based on reported data, to expand the ATE effort past the local college, sustained personal college-to-college relationships work the best. Community colleges working together on similar technical programs provide a vehicle for focused adaptation of materials and establishes a mutual support system. During site visits, *projects* reported that, by working in unison with other colleges, their efforts had a greater impact than if products were simply "made available."

[29] *Profile of the Community College.* 29-32.

The site visit reports provide several examples that are clearly models of this type of collaboration.[30] A description of the characteristics of these success models is presented below.[31]

Model 1 – The national or regional decentralized consortium: This arrangement creates a focal hub point that has overall responsibility for the *project's* activities and is the contact point for administrative and management functions. The focal point, in turn, develops a national or regional network of semiautonomous community colleges that serve a distinct geographical area and are responsible for facilitating achievement of the mutually agreed upon consortium goals in their area. A formal structure that fosters communication, sharing of resources, developing and sharing materials, and assessing progress is created. The structure provides for scheduled progress review meetings of the consortium focal point and decentralized subproject leaders. In this model, the decentralized subproject entity (usually a single community college) forms its own collaborative arrangements with area schools, business/industry, and senior colleges or community colleges. The decentralized subproject also has specific responsibility for materials development and program improvement in one of the consortium program areas. The central focal point may or may not have such a responsibility.

This model capitalizes on the unique relationship community colleges have with their communities. The local colleges (assuming a positive reputation) can marshal resources in their area and achieve the workforce improvements in that local area that would not be possible for an outside college. These improvements have a central core of competencies in line with ATE objectives and expand the influence of ATE-supported efforts to a region, not just a single community. The key to success is ensuring mutual interest in achieving the goals and a willingness among partners to work cooperatively with others. A major advantage of this model is that turf battles are avoided, since as each subproject operates in its normal service area and retains its own program and managerial autonomy. A note of caution: In reviewing reports on the effectiveness of the *projects* using this model, it was evident that sufficient resources must be allocated to manage the national/regional consortium or an excess degree of independence (i.e., lack of oversight and monitoring by the focal point) of partners can reduce the effectiveness of a *project* in meeting overall goals.

Model 2 – Statewide consortia: In this model, the state system of community colleges is involved as a player. The funded entity could be the state governance agency for community colleges or one of the colleges in the system. The focus is to create or improve technical programs to meet statewide economic development goals through workforce development. State system colleges serve as partners in the development effort including standards and curriculum development and faculty professional development. The business and industry

[30] The models presented are a synthesis of data reported by visited sites. Although several sites primarily used one of the presented models, other sites exhibited characteristics of portions of several models.

[31] Collaboration is a process to bring about an outcome. In this case, the overall outcome is dissemination of the benefits of improved technical education. Subobjectives of the collaborations described in this paper often include materials development, resource support, recruitment and placement, etc. In other papers describing the ATE program, the formation of collaborations may be addressed as means to a specific end. The models presented are offered as an overall approach to expanding the influence of ATE.

participation is normally a mix of statewide and local collaborations, and the state economic development agency is normally a significant contributor toward enlisting business/industry support. The state department of education often provides support through its ties with local school districts. However, the local community colleges still must create local school system interest in a mutually supporting relationship. Depending on the community college system's structure, several geographically strategic community colleges may serve as regional coordinators and as part of a *project's* management team and receive funding support from the grant. Once developed, products are made available to all colleges. Articulation agreements with senior colleges normally remain a college-by-college responsibility. However, as a statewide effort, there seems to be potential for statewide articulation, although none was reported from the sites visited.

A variation of this approach is for a limited consortium of a group of state community colleges. These may be formed around aligned geographic service areas or common business or industry workforce needs. In the limited consortium, there is less direct involvement of state agencies than in the statewide approach and more reliance on perceived mutual benefits resulting from the collaboration. As in most consortiums, one of the players is required to be the focal point for the ATE effort.[32]

In reviewing the site visit reports describing statewide *projects*, it was clear that the strength of the community college system is a critical factor. State community college systems that have structured procedures and mechanisms for developing and approving curriculum materials are the most successful. Under such an established protocol, uniform statewide student competencies, curriculum materials, and course syllabi are readily accepted without turf wars that arise when each institution has its own approach. With an in-place system, the energy normally expended on reaching procedural consensus can be directed to improved product generation. One final note concerning the statewide model, a systemwide effort can often bring added support from the state's executive and legislature branches. This was evident in the report of one such project.

Model 3 – Central product development with nationwide users: In this approach, the curriculum product development is centralized and managed by the *project*. Product development can be done in-house or by compensated development teams. Liaison with industry professional societies and/or user groups is often established to stimulate cross-industry support versus dealing with one company. This nationwide collaboration with a specific industry provides product creditability. The products that best fit the centralized development are instructional modules that can be adapted by multiple users in a variety of settings. The central *project* leadership is responsible for attracting "customers" for the product. Although the customers are characterized as "partners," their collaboration is (at least in the reported project) limited to buying and using the product. The strength of this model is the potential distribution of the products nationwide in support of a major industry. However, interesting users who have had little or no say in the product's development is a challenge. The credibility of an industrywide-supported product can decrease the impact of

[32] *Advanced Technological Education, Program Announcement* 97-29, p. 2.

this challenge. Also, this model can result in sizable central *project* staffs that may not be sustainable once grant funding has ended.

An example of creating a nationally available product is the use of professional societies or similar organizations with a specific interest in improving technical education. In the reported data concerning such an arrangement, the collaborations formed involved various industries as product advisors and materials development sites. Additionally, a national network of education professionals served to pilot test and critique the materials during development. A professional publisher was the catalyst for producing the finished product and its distribution. Plans were in place for expanding and updating the materials using the initial collaborative process. In this approach, the ongoing collaborator was identified as the publisher; however, this was clearly a commercial arrangement and not one growing out of workforce development concerns of the publishing company and would more correctly be characterized as a dissemination approach.

Site visit reports provided data on several single college efforts under the ATE program. In analyzing these data, it was evident that the colleges involved did produce improved technician education programs with an expanded impact. They essentially used the types of collaborative arrangements described above. However, these arrangements, particularly with business and industry, were limited in scope (often one or two meetings with representatives of local small businesses). This type of collaboration may serve to develop a program meeting local needs, but would seem to have a minimal chance of providing widespread adaptation by other colleges.

Conclusions

Based on those data contained in the WMU evaluation project surveys and site visits, it is clear that ATE projects/centers are using collaborations effectively. The overall positive impact of these collaborative arrangements on ATE's efforts to create advanced technological education is significant. Although some adjustments can improve the collaborative effort, clearly the objective of partnering educational deliverers and business/industry to produce a world-class workforce is a strong point of the ATE program. Based on analyzed data, the following specific conclusions seem reasonable concerning ATE centers'/projects' use of collaboration:

- The use of collaborative arrangements by *projects*, especially community college based *projects*, is widespread and a fundamental characteristic of the organizational entities involved in leadership roles.

- The ATE *project* was the initiator of the collaborative arrangements.

- The collaborative efforts included appropriate members for the intended outcomes.

- The greatest numbers of *project* collaborations were formed around business/industry, K-12 (primarily secondary) schools, and community and/or four-year colleges.

- Most collaborations with business and industry seemed to focus on workplace standards development and work-based educational experiences.

- Business and industry were not normally involved in verifying the validity of newly developed curriculum products.

- All reported collaborations had a focus on the *project's* goals, objectives, and desired outcomes. The degree that these were shared with partners varied, but in general, there was an adequate awareness of the ATE *project's* focus.

- The reported data did not indicate that a clearly defined mutual benefit to *project* collaborators had been routinely established. This was particularly true in collaborations with business and industry and with K-12 schools.

- The reported collaborations varied widely in duration and formalization. The range was from short, ad hoc relationships of a few days to long-term, sustained relationships based on formal agreements.

- Since those data gathered were from currently active *projects,* there is no way to judge the persistence of the collaborations after grant funding.

Recommendations

Based on these conclusions, the following recommendations are provided for NSF and ATE *projects.*

Recommendations for ATE.

1. *Project* proposals should clearly identify the expected collaborations to include types of membership, duration, purpose(s), and expected outcomes.

   Since collaboration is a major element of successful ATE projects, it is important for ATE to understand with whom, why, and how those proposing a *project* intend to proceed with partnering. By specifying that proposals include a section describing intended collaborations, ATE can ensure that the *project* is approaching collaboration in an appropriate way.

2. ATE should encourage statewide, regional, or national consortia as part of the collaboration model for large *project* awards.

   To obtain the "biggest bang for the buck," ATE *projects* need to reach the maximum number of users possible for their products. Data gathered during site visits indicate that collaborative arrangements involving multiple educational deliverers have the greatest potential for product spread and adaptation.

3. ATE should actively facilitate center-to-project collaboration and, where similar outcomes are identified, project-to-project collaboration.

   Data indicate there is little collaboration between centers and projects with similar expected outcomes. Projects are significantly smaller and have limited resources to disseminate their products, and the greater reach of centers can enhance wider dissemination. One possible approach is for ATE, when funding their activities, to provide *projects* with a listing of specific potential partners and task centers to nurture a collaborative arrangement with projects. Since centers' funding spans a significant period of time, periodically updating the list of potential project partners would be required.

4. For *projects* involving development of technical curriculum products, business and industry involvement in verification of the product effectiveness should be required.

   Projects are doing a creditable job in enlisting business/industry support for most technical education activities. The only issue noted in reported data is in the limited use of business/industry expertise in validating products or programs. ATE should require *projects* to include business/industry representatives in pilot/field-testing activities as part of the evaluation of *project* success in developing and implementing products associated with technical work-based knowledge and skill.

5. ATE should provide guidance on best practices for sustaining collaborations beyond *project* funding and systematically gather data concerning collaboration sustainability.

   Some collaborative arrangements engaged in by *projects* are dependent on funding (e.g., sustaining meaningful contact with other educational deliverers) and may not persist past ATE funding. Since technical programs are dependent on continual improvement to stay abreast of the needs of business/industry for skilled technicians, ATE should provide *projects* with guidance on how best to ensure that these collaborations continue after funding ceases. As part of the overall evaluation of ATE, data on the degree collaborative activities persist after funding should be gathered. This should be part of an overall evaluation strategy that looks at the post *project* impact of ATE.

Recommendations for ATE centers and projects.

1. Establish sustained relationships with business/industry throughout the *project's* funded life and beyond.

2. Clearly identify the benefit of cooperation and support that accrues to collaborating partners.

3. Formalize membership, objectives, procedures, and anticipated outcomes for collaborations.

4. Facilitate appropriate levels of contact with collaborators, and seek meaningful input toward goals, and keep them informed of progress.

5. Clearly identify the NSF-ATE role in the *project*.

6. Involve businesses and industries in verifying the efficacy of technical curriculum products.

7. Form collaborations that extend the reach of the *project*.

8. If a collaborative relationship is not working fix it or disband it.

Suggested Approach to Evaluation

Below are 14 questions for use in evaluating ATE-supported collaborations. The answers to the questions can provide a matrix of data on which to judge the collaboration's purpose, membership, persistence, and effectiveness in meeting goals of the ATE-supported *project*.[33] These questions can also serve as a framework for planning and designing collaborations that have a high probability of success.

1. What is the purpose of the collaboration?

2. Does the purpose clearly relate to the goals of the ATE *project*?

3. Is the purpose of the collaboration defined, and are partners aware of the purpose?

4. Is the membership of the collaboration appropriate for the purpose?

5. Do the partners in the collaboration understand the ATE involvement?

6. Does the collaboration provide mutual benefit to members?

7. Is there a formal structure for the collaboration?

8. Was collaboration initiated by the ATE *project*?

9. If the collaboration predated ATE funding, is there evidence that ATE resources have strengthened the collaboration?

[33] The profile created from answers to these questions should be compared with the definition and collaboration elements discussed above to determine the degree to which a *project* partnership is meeting the intended goal of successful collaboration.

10. Does the ATE *project* routinely communicate with and keep partners involved in activities related to the stated purpose?

11. Is the collaboration a long-term or a limited relationship?

12. How effective is the collaboration in achieving its stated purpose?

13. Does the collaboration link the *project* with partners that provide an expanded network for integrating the *project's* products into workforce programs beyond the service area of the *project* organization?

14. What is the probability that successful collaborative efforts will persist after ATE funding ceases?