ASSESSING THE VALUE ADDED BY NSF'S ATE PROGRAM: BUSINESS AND INDUSTRY PERSPECTIVE'S CROSS-SITE ANALYSIS REPORT

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Executive Summary

The National Science Foundation's Advanced Technological Education (ATE) program was designed to (1) produce more science and engineering technicians to meet workforce demands and (2) improve the technical skills and the general science, technology, engineering, and mathematics (STEM) preparation of new technicians and educators who prepare them. The majority of ATE funding is directed at the community college level in order to strengthen and expand the scientific and technical education and training capabilities of individuals at these institutions.

The evaluation of ATE is intended to assess both the impact and effectiveness of the program. This report presents the results from a targeted study designed to address the accountability of the ATE program in terms of its impact on the business and industry workforce. Specifically, this study sought to answer whether and how the ATE program adds value to businesses and industries via the community college-educated technician workforce in the communities served by ATE-funded programs.

Data for the study were gathered from business and industry representatives via site visits to 9 locations throughout the United States. Five ATE sites were selected by NSF program officers who judged the ATE projects successful with regard to the overall mission of ATE. Four non-ATE locations that are served by colleges that provide programs in similar technologies but had not received ATE funding were chosen as comparison sites. A total of 24 businesses were visited by the site study team at these 9 locations.

Findings

Interviews, observations, and materials collected via the site visits provided the data used by the evaluators to determine the value added by the ATE program to the business and industry workforce. In the course of collecting data, the term "value added" evolved to include benefits to business and industry in terms of four elements: (1) the numbers of technicians trained and available, (2) the quality of the technicians trained, (3) improved business results, and (4) reduced costs for business.

Based on our analysis, multiple, interrelated factors impact community college programs' ability to "add value" to business and industries, irrespective of whether or not they receive ATE funding:

- Motivation for the collaboration
- The match between businesses' and industries' needs and colleges' abilities to meet these needs
- The economic base of the region where the businesses/industries and colleges are located
- Industry characteristics
- Employee knowledge and skill requirements
- The ability of community colleges to attract and recruit qualified students
- The quality of education/training available to these students
- The level of communication between local businesses/industries and community colleges

Across the nine site visits, evaluators observed a diverse set of collaborations between businesses, industries, and community college technician education programs. We classified these collaborations into the following four models as a means to both describe general attributes of the collaborations and the results obtained:

1. Consolidated Industry Model: Collaboration with multiple companies of a common industry develops technicians having skills tailored to the various needs of the industry.
2. Retraining/Up-Skilling Model: Collaborating with a variety of companies and consortia of companies typically provides specialized training/education in a targeted technical area.
3. Company Marketing Model: Collaboration with an individual company provides technician education targeted to that company's needs.
4. Mixed-Industry Model: Technician development collaborations are tailored individually with a variety of dissimilar companies in the locale or region.

The most important characteristic across these models reflected who initiated the relationship. Based on this attribute, we labeled collaborations as "push" or "pull." When the community college sought collaboration with business and industry to serve its education of technicians, we called it a push. When business and industry sought collaboration with the community colleges to serve its internal technician needs, we called it a pull. In our study, the consolidated industry, retraining/up-skilling, and company marketing models were characterized as "pull" models; the mixed-industry model was a "push." It is significant that the mixed-industry model was the most commonly observed type of collaborative relationship. Across both ATE and non-ATE sites, pull relationships resulted in business-perceived greater value-added benefits than did push relationships, irrespective of the various contextual factors.

Conclusions and Recommendations

Site visit respondents consistently stated that the ATE program adds value to collaborating businesses and industries. In this regard, the ATE program is reaching its intended audience and making a positive impact. ATE-funded technician education programs provide benefits in terms of the numbers of technicians educated/trained and available, the quality of these technicians improved business results, and reduced costs for business.

Comparison of findings from the ATE and non-ATE sites serves to strengthen the direct response findings from respondents. Consistently, these findings favor the ATE program in such ways as (1) communications and collaborations across business and industry groups, (2) capability to respond quickly and effectively, (3) quality of education, (4) numbers reached through the program, (5) greater attention to faculty development in areas of business and industry needs, and (6) matters of financial means and impetus.

The college sites employ similar models for engaging with business and industry. Altogether we identified four models of which three were employed at both ATE and non-ATE sites; we observed the fourth, company marketing, only at a non-ATE site. As noted in the findings, each model had its own strengths, weaknesses, and dependencies on the local context.

Despite their unique characteristics, the four models enjoy many similarities in methodology:

- All include substantial collaborative arrangements between the companies and the colleges to serve development of technicians.
- All provide technician education as course-based opportunities.
- All provide degree and/or certification program options for participants.
- All provide proximal and hands-on instruction. All but the company marketing model included mechanisms to provide at least some instruction to students on site at a company or in close proximity to participating companies. The company marketing model made its equipment and software available on the college campus.
- The consolidated industry and company marketing models engage in substantial curriculum development and use of full courses for teaching aspiring technicians prior to their joining the workforce.
- The consolidated industry and mixed-industry models engage students in internships serving the needs of collaborating companies.
- Company employees, as instructors, were found in three models (all but company marketing).
- All but the retraining/up-skilling model involve the college faculty members integrally in matters of instruction.

Consistently these methodological points of commonality were viewed as strengths of the respective models. Even with these points of commonality, there is considerable variation in use both within and across these models. One of the perceived strengths of the ATE program was the many ways in which the educators engaged collaboratively with the business and industry representatives to tailor the models to fit local situations.

The extent to which the colleges serve industry is heavily dependent on local contexts and collaborative arrangements. Where there was commonality in industry and needs in the locale, the program could be narrowly focused on an industry and provide extensive service, tailored courses, internships in targeted areas, and improvement of faculty to better teach key courses.

Where the company used the college as a marketing tool, the college gained state-of-the-art equipment and materials (huge monetary support). The companies in turn gained substantial access to the college, opportunities to use the college as a showcase, and large numbers of students receiving in-depth instruction on company equipment.

Where companies had limited needs for new technician employees but desired increased skill among current employees, workshop and special courses were matched to company needs. These matched instructional programs tended to be limited in duration but with good potential for impact at the participating company or companies.

Where industry needs were diverse in the locale with only small technician needs per company, the extent of service to the companies tended to be smaller. In those situations, internship programs appear to be favored as a collaborative tool. Representatives of several companies spoke positively of internships as a recruiting tool for the company, as a strong educational tool for the interns and associated employees, and as an important mechanism for maintaining contact with the college—though with stress related to supervision.

Across all sites, the effects of instruction reach beyond those taught, affecting others in their companies of employment. Those touched by the courses in a sense infiltrate the companies to change behaviors and practices.

Because of the U.S. economic downturn,[1] there was much less demand for new technicians than we anticipated. Few companies were willing or able to provide clear statements of their needs for more technicians.

In situations where increasing the supply of technicians was important, two of the described models, consolidated industry and company marketing, were the dominant modes for serving industry-based needs in technician-demand situations. Both models produced courses tailored to serve the collaborating companies. The consolidated industry model, however, appears to be broader in scope—providing degree and certification options and serving the needs of multiple companies. The company collaboration examples we saw produced technician skills in a single area, albeit one in high demand and at the cutting edge.

Even when increasing supply was not important, company representatives viewed the colleges as a continuing source of technicians for their company needs. These representatives noted that by working with the colleges, they reduced company training costs while providing the company with an overall stronger technician workforce.

Companies highly valued community college efforts to serve their needs for improving technician skills. The retraining/up-skilling model was mostly used for those purposes, though the consolidated industry model also provided opportunities for current employees to enter the college program to improve their skills and advance within the company. Company representatives valued both program efforts and indicated that these efforts did improve the quality of their technician workforces. Despite companies' strong support for the retraining/up-skilling model, we retain concerns about its use. Most often this model was implemented through what we termed a college-broker approach, which provided little programmatic benefit to the college.

Across all sites the substantial influence of who "drives" the collaboration, whether it is college or industry instigated, stands out as a major indicator of success. Internal company drivers (i.e., needs internal to businesses or industries) provided greater incentives for successful collaborations than external drivers or factors that emanated from the college's perspective. Therefore, how colleges can get business/industry to ask for help becomes an especially important matter. This means it is important for the college to come to the companies not with a stated method (e.g., internship) they want to impose but with questions regarding what the company's technician-based needs are and how the college can engage with them to serve the needs.

[1] Site visits to the 9 communities were conducted from March through December 2003.

The mixed-industry model best exemplifies the college-instigated collaboration. In a mixed-industry situation, trying to serve the many disparate needs likely requires careful balancing to ensure that the college can respond in viable ways. We encourage engaging the local advisory committee to sort through these disparate needs to focus collaborative work and best serve the industries. Certainly, these committees are uniquely positioned and most likely qualified to address these issues.

Though most evident in the company marketing model, representatives from all sites regularly spoke to the need for and importance of highly knowledgeable and skilled faculty. Consistently, respondents wanted local faculty to increase their knowledge and skills in ways that would better serve their technician needs. The ATE program already focuses heavily on faculty development, but the specific interest in increasing local college faculty members' knowledge and skills bears careful examination from several perspectives. First, in almost every case, the number of faculty members affected is small—too small to be a basis for a local faculty development workshop. Second, this type of development requires that either an expert or experts be brought to campus or that the specific faculty members go to other locations to gain the requisite skills. Both likely carry substantial costs on a per-person basis. Third, when the faculty members do gain the desired knowledge and skills, by whatever faculty development method employed, these individuals are likely to be highly marketable and may move from the college. Thus considerable investment may yield relatively little local benefit. For those reasons it likely is difficult for the local community college to justify spending its resources on this type of faculty development.

Yet, given the national interest in improving technician skills, this seems particularly well suited to ATE aims. We believe the findings support a continued ATE emphasis on faculty development and especially encourage an emphasis on developing faculty skills in areas important to local technician demands. Where commonality in skill development can be established across sites, we encourage the sites to join together to construct and conduct institutes or other means to bring about these types of faculty development.

In addition to common methods, we noted three attributes that flow from these models:

- Strong communication/exchanges between local businesses, industries, and the college programs (business/industry personnel acting as adjunct faculty, involvement of business persons on training boards, etc.)
- The capability of the local community colleges to both understand and meet local business and industry needs (collaborations via local business councils appears to be a good way to develop and increase this understanding)
- The presence of mutually beneficial relationships between businesses/industries, and the local college programs (e.g., providing machines to the college in exchange for being able to use the college lab as a machine showcase)

Certainly, the ATE program has fostered development of these attributes, and they serve the value-added intentions of the program well. We encourage the ATE program to continue fostering them.

Finally, we note the importance of fiscal viability. While we only sought to address matters of technician demand (numbers) and quality, company representatives noted that reduction in company costs and ability to meet marketing objectives also serve as powerful inducements to collaborate. Neither reduced costs nor company marketing is an objective of the ATE program. Yet, we concluded that both serve as intervening variables, promoting the stated aims of the ATE program. We don't encourage ATE support to reduce business costs or to improve their marketing capabilities. At the same time, where these variables encourage business/industry involvement for reaching ATE objectives, we believe they should not be viewed as barriers or hindrances to ATE support.

Ultimately fiscal viability boils down to company profitability. At every business we visited, company representatives spoke to the importance of producing a profit for its stockholders or owners. Points mentioned as important were engaging the college to improve the working conditions for employees, increasing safety, making them more skilled in their work, and raising the productivity on the work floor. Yet, these representatives always finished by saying in one way or another "but we have to make a profit." This means that the individual colleges and ATE must remain mindful that profitability is and likely will remain the most important criterion used by companies to determine the viability of their technician-education collaborations with a community college. Perhaps the greatest challenge to ATE and the community colleges is how to best orient and use that interest in profits to serve improvement in technician education at the community colleges.

Assessing the Value Added to Business and Industry by NSF's ATE Program

The National Science Foundation's Advanced Technological Education (ATE) program stems from a national interest in developing and using technology to meet the nation's education and workforce needs. Funded via a Congressional mandate, the ATE program was designed to (1) produce more science and engineering technicians to meet workforce demands and (2) improve the technical skills and the general science, technology, engineering, and mathematics (STEM) preparation of new technicians and the educators who prepare them. The majority of ATE funding is directed at the community college level in order to strengthen and expand the scientific and technical education and training capabilities of individuals at these institutions. More specifically, the objectives of the ATE program are to

- Develop model instructional programs in advanced technology fields.
- Provide professional development to faculty and instructors in advanced technology fields.
- Establish innovative partnerships between associate-degree granting colleges, businesses, industries, and other public and private sector entities that need and employ skilled technicians as part of their workforce.
- Develop and disseminate instructional materials.

As part of the ATE program, NSF included funding for evaluation to assess the impact and effectiveness of the program. The evaluation, conducted by The Evaluation Center at Western Michigan University and faculty and staff at the University of Minnesota, has sought to answer four basic questions deemed important to ATE and its stakeholders:

1. To what degree is the program achieving its goals?
2. Is the ATE program making an impact and reaching the individuals and groups intended?
3. How effective is the ATE program when it reaches its constituents?
4. Are there ways the program can be significantly improved?

Study Overview

This study is one part of the ATE program evaluation. It was designed to address ATE's programmatic impact on the business and industry workforce and assess its strengths and weaknesses. Though the report addresses many items, this study specifically sought to answer whether or not the ATE program adds value to local businesses and industries through the community college-educated technician workforce. For the purposes of the study, "value added" was operationally defined to mean that more technicians are produced and that these technicians are better prepared. This study sought to learn three things from business and industry representatives: (1) their needs for community college-prepared technicians, both in terms of numbers of technicians and technician knowledge and skills; (2) how and to what extent the local community college serves industry's technician workforce needs; and (3) ways in which business/industry and community colleges can better collaborate to improve preparation of technicians to serve identified workforce needs.

Data were collected in communities where ATE support is provided and where no ATE support has been granted. These data enabled the evaluators to contrast the impact of ATE-supported programs with those that have not received ATE support. This dichotomy aided our determinations regarding the impact of the ATE program.

Data were only collected from business and industry representatives. Evaluators did not concomitantly visit the community colleges connected with these sites, nor did they seek to assess the degree to which these community colleges were meeting their ATE mandates. The focus of this study was solely from business and industry representatives' perspectives of their relationship with local community college technician education programs and what they believe they have gained from this relationship.

Methodology

We employed a purposeful sampling strategy to identify businesses and industries from which to gather data. First, community college locations were identified. Second, persons at the community college were contacted to determine who in the business/industry community collaborated with them. Through this process we identified and gathered data from business and industry representatives at 24 companies in 9 locations throughout the United States.

The process called for first identifying community colleges that currently have an ATE project. Five sites were selected by NSF program officers who judged these ATE projects to be successful in the overall framework of the ATE program. Each selected project had to have been in existence for at least two years. Additionally, the selected projects represented a cross-section of the disciplines in the ATE program (information technology, chemical, manufacturing, etc.). The goal of this sampling strategy was to purposefully choose exemplar ATE projects, though they were not necessarily known to be exemplars in terms of their business and industry collaborations.

The project director of each selected ATE project was then contacted by e-mail and telephone to solicit names and contact information for businesses and industries that the director thought exemplified their collaborations. In turn, we contacted the business and industry representatives to solicit their participation.

Once ATE sites were selected, five non-ATE locations were chosen as comparison sites. To obtain these comparison sites, evaluators first searched Web indexes of community colleges to create a sampling frame. A community college was included in the sampling frame if it provided an instructional program similar to the one offered at a selected ATE site. In addition to program similarities, college enrollment size (similar) and geography (diverse where possible) were used as key qualifiers. Colleges that met the key qualifications were then checked to confirm that they had not received ATE funding. Evaluation team members then reviewed individual college Web sites to confirm each site's qualifications and to choose one comparison site for each ATE site.

Once a comparison community college was chosen, a faculty member or program coordinator at the site was identified to assist in identifying collaborating businesses and industries. While the process at the comparison sites paralleled that for ATE projects, development of site visits was more difficult. We believe this was due to business and industry representatives having less incentive to be interviewed since they did not benefit from the NSF's ATE program support.

Because of difficulties in making site visit arrangements, one comparison site visit was not completed.

Though we exercised care in the selection of comparison sites, we again note that comparison sites were selected in a purposeful manner (not random). Therefore, we cannot provide assurances of equivalence between the comparison sites and the ATE sites.

For ATE and non-ATE sites, the process for setting up site visits was similar. Initial contact was made with the community college representative, and a request was made for assistance with the ATE program evaluation. That initial contact was followed by a telephone call. Subsequent e-mail and phone communications elicited nominations of appropriate businesses with necessary contact information supplied. We then contacted these businesses via e-mail and follow-up telephone calls. Written information was often requested since the business contacts typically needed approval for the visit from superiors in their organization. Once approval for the visit was obtained, the evaluation project manager confirmed logistical details.

As shown in Tables 1 and 2, the ATE and non-ATE sites visited represented multiple industries and technical areas (e.g., marine technology, manufacturing technology, machine technology, etc.). By design, non-ATE sites represented similarly diverse industries and technical areas as the ATE sites. Tables 1 and 2 also indicate that the numbers and roles of business and industry representatives interviewed varied both across areas (ATE and non-ATE sites) and within areas.

Table 1. ATE Sites (n=5) and Businesses and Industries Sampled (n= 15)

Site	Informants
Site 1	
Company 1	Technician supervisors (n=3), technicians (n=7), human resource staff (n=2) (n=12 total)
Company 2	Systems support director (n=1), contract administration manager (n=1), engineering team leaders (n=2), human resource assistant (n=1), Vice President for systems and Integration (n=1) (n=6 total)
Company 3	Uniformed military employees (n=6), U.S. civilian government employees (n=5) (n=11 total)
Site 2	
Company 4	Owner (n=1 total)
Company 5	Owners (n=2 total)
Company 6	Oceanography researcher (n=1), marine operations supervisor (n=1), engineering supervisor (n=1), education specialist (n=1) (n=4 total)

Site	Informants
Site 3	
Company 7	Human resource person (n=1), technicians (n=5) (n=6 total)
Company 8	Community college liaison/human resource staff person (n=1), technician supervisors (n=2), technician (n=1) (n=4 total)
Company 9	Community college liaison (n=1 total)
Site 4	
Company 10	Education and training supervisors (n=2), technician supervisors (n=4), process technicians (n=3), human resource person (n=1) (n=10 total)
Company 11	Education and training supervisors (n=2), technician supervisors (n=3) (n=5 total)
Company 12	Education and training supervisors (n=2), technicians (n=2), human resource person (n=1), union representative (n=1) (n=6 total)
Site 5	
Company 13	Manufacturing technician (n=1), college contact (n=1), supervisor (n=1), technicians (n=2) (n=5 total)
Company 14	Training resource administrators (n=3), technician supervisor (n=1), technicians (n=2), intern (n=1) (n=7 total)
Company 15	Human resources administrator (n=1), technicians (n=2) (n=3 total)

Table 2. Non-ATE Sites (n=4) and Businesses and Industries Sampled (n= 9)

Site	Informants
Site 6	
Company 16	Technician supervisor (n=1), technicians (n=2), human resource administrator (n=1) (n=4 total)
Company 17	Technician supervisor (n=1), technicians (n=2) (n=3 total)
Site 7	
Company 18	Director of regulatory affairs (n=1), president (n=1), operations manager (n=1) (n=3 total)
Company 19	Operations manager (n=1), plant supervisors (n=2) (n=3 total)
Company 20	Executive vice president (n=1 total)

Site	Informants
Site 8	
Company 21	President (n=1), instructor (n=1), technical administrator (n=1) (n=3 total)
Company 22	General manager (n=1 total)
Site 9	
Company 23	Production services director (n=1), production supervisors (n=2), synthesis technicians (n=2), general technician (n=1), operator (n=1) (n=7 total)
Company 24	Human resource manager (n=1), safety technician (n=1), loader (n=1), shift supervisor (n=1), board operators (n=2) (n= 6 total)

For this study, each site visit team included two to three individuals. One person acted as the team leader. Team leaders were responsible for organizing team members and assigning their responsibilities, leading the site visit, and coordinating report writing. In all cases each team included one of the two ATE evaluation principal investigators and at least one other person. Additional persons were usually an external consultant who was knowledgeable about evaluation theory and practice and/or someone whose expertise included business and industry settings and practices. Of the four non-ATE sites visited, three sites were visited by teams consisting of two members. Additionally, at three of the non-ATE sites, only two companies were visited. Finally, no non-ATE comparison site was available for the Information Technology ATE project due to difficulty in securing cooperation from a suitable comparison site.

A site visit packet (see Appendix A) was presented to all study team members in advance of their site visits along with additional information about the businesses/industries that were to be visited. Study teams usually traveled to the site the night before the first site visit, met, and made final preparations for the visit. The teams debriefed after each site visit to share thoughts, perspectives, and findings.

Study teams met with business/industry representatives as a group or individually as needed and followed the proscribed site visit protocol designed by senior staff at The Evaluation Center with input from multiple ATE stakeholders. In most cases visits to a business or industry concluded with a tour of the facility, although this was not possible at a few companies due to security concerns. Generally, site visits lasted two to three days with half-day visits to each of the participating businesses/industries.

Upon completion of the site visits and after debriefing, study team members wrote individual reports on each business/industry visited based upon written notes taken during the visit. From these reports a cross-business/industry report was developed. The cross-business/industry reports tended to address four main areas of interest:

1. Characteristics of the interview process (described above)
2. Characteristics of collaboration between businesses, industries, and technician education programs
3. Value added by the relationships
4. Factors affecting the value-added nature of business/industry and community college relationships

Findings

Cross-business/industry reports detailing findings from the nine sites were analyzed for this report. Data were first organized using ATLAS.ti, a qualitative software package.[2] Initially, seven issues or themes were used for organization purposes: the four areas (noted above) reported in the cross-business/industry reports and the three overarching questions stated in the Overview (needs for community college-prepared technicians, extent to which the needs were served, and ways to improve collaboration). Through iterative steps in analysis and writing of results, we narrowed presentation of findings to three key items: (1) value added by the community college relationships, point 3 above; (2) factors affecting the relationships, point 4 above; and (3) characteristics of the collaborations, point 2 above. Information regarding the other four points has been woven into discussion of these three main points.

Value Added

This study focused on the question of value added to business and industry by community college technician education programs. We found substantial evidence of value added. That is, participating businesses and industries benefited from their collaborations with community colleges. Consistently, those interviewed at the ATE sites knew of the ATE program, valued it, and could identify ways in which the program benefited them. As described more fully later, these representatives reported a variety of benefits, especially in terms of company marketing and cost reductions, which we had not thought to include when we initiated the study. For example, we had not thought to include several items tied to business marketing (e.g., use of school locations as show rooms for equipment), the reduction of business costs (e.g., reduced travel expenses), or development of new profitable business relationships (e.g., bringing different industries together in collaborative relationships). Costs reductions by themselves were significant. At one location a company estimated that it cost approximately $5000 to have the community college train 100 people as opposed to paying $2000 plus travel costs per person to

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[2] ATLAS.ti organizes qualitative data into a project or "hermeneutic unit" that facilitates the activities involved in analysis and interpretation—in particular, selecting, coding, annotating, and comparing noteworthy segments. It also enables rapid search, retrieval, and browsing of all data segments and notes relevant to an idea. Perhaps most importantly, it allows researchers to build unique networks to "connect" visually selected passages, memos, and codes and construct concepts and theories based on the relations and reveal others.

have people attend seminars, etc. for training.   Those huge savings made it feasible to involve large numbers of technicians in substantial up-skilling programs.

In the study's design we included both ATE and non-ATE sites for comparative purposes to help determine the effects of the ATE program. However, those comparisons do not enable clear distinctions between ATE and non-ATE collaborative efforts. The variations among companies, persons interviewed, demand for technicians, and a host of other variables intervene and color findings. Yet, the interview findings do point to advantages of the ATE program. These findings reach across the contextual settings and collaboration strategies (models) employed. Our findings did not suggest benefits unique to the ATE program. Rather, the ATE benefits appear as general tendencies (e.g., more or better, and more quickly).

Here we focus on the following questions:

1. From the business and industry perspectives, what constitutes value added?
2. Do community college collaborations with business and industry benefit (add value) the business and industry stakeholders?
3. Does the ATE program itself add value to the collaborative relationships?
4. If value is added by these collaborations and more specifically by the ATE program, what is the nature and extent of value added?

Companies view the nature of value added more broadly (i.e., having more facets) than we did in our conceptualization of the study. As originally defined, value added pertained to effects (impact) on business and industry collaborative partners of the community colleges and contained two key elements: (1) more technicians are produced and (2) these technicians are better prepared.

Interview data revealed two additional aspects to be included and caused us to more fully delineate the two initially included elements Business and industry representatives noted that they gained value from their relationship with the community college technician training programs via

1. The numbers of technicians trained and available.
2. The quality of the technicians trained.
3. Improved business results.
4. Reduced costs for business.

Including all four elements in this definition more appropriately captures the values and benefits of the community college technician education/training collaborations for business and industry as expressed in our interviews with business and industry representatives. Table 3 provides the essential information for determinations about each of these four elements.

Table 3. The Operational Definition of Value Added

Definitional Element	Element Criteria
Numbers of technicians (supply)	• Training a high number of technicians • Providing a pool of local technicians • Retraining and "up-skilling" existing workers • Career awareness (attracting students to the industry)
Quality of technicians	• Providing better quality technicians than were available previously • Aligning measurement of student skills requirements to what industry needs for incoming technicians (industry skill standards) • New and better curriculum development • Professional development for faculty • Providing cutting-edge technology
Improving business results	• Stronger job performance (e.g., productivity, safety) • Marketing • Bringing different industries together in collaborative relationships, i.e., providing structure and sustainability
Reducing costs for business	• Screening of existing and potential employees (selection device) • Reduction of training costs (e.g., local sourcing, scheduling flexibility, direct costs, etc.) • Providing technicians more quickly • Happy employees/ reduced turnover

Numbers of technicians. Most companies reported only small needs for newly-trained technicians. When this study was planned, the U.S. economy was in high gear and the need for more technicians was prominent in the news and ATE discussions about technician education. By the time data gathering took place (2003), the economy had been in a downturn state for two years. As a result, few companies were seeking many new technicians. Instead, many were maintaining their current workforce or had reduced size. Only at one site do findings suggest that increasing the number of technicians was a key part of the value added by the ATE program.

In the observed economic climate, substantial program emphasis was directed to "retraining and up-skilling" current technician staff. Here both ATE and non-ATE collaborations were used to good advantage. Where sites often listed their annual needs for new technicians as 1 or 2, they engaged larger numbers, sometimes 40 to 60, in courses designed to improve technician skills. ATE projects provided more of these experiences, and collaborating companies found them to be beneficial.

At six sites, career awareness was viewed as a positive, although limited, benefit of the collaborations. At four sites, the benefit accrued through a student's direct work as an intern at a company. At a fifth site, students learned of the collaborating company and career opportunities from instruction on machinery or software provided to the college by the company. At the sixth site the degree program focused on preparing students for technician work in the industry. Industries viewed these preparatory courses and internships as low-risk ways for students to learn about them and for them to identify and select students.

Quality of technicians. Collaborating companies provided strong affirmation of improvements on this front. Representatives at multiple companies noted improvements in the quality (knowledge and skills) of technicians. These representatives reported that the improvements were due to (a) improved and updated curricula used with new technician students and (b) customized education programs for current workers for achieving a qualified and capable workforce. Concomitantly, company representatives regularly provided anecdotes regarding the substantial effects these curricula have on students and the subsequent impact that these better educated students had within their companies.

The relative advantages of ATE over non-ATE programs were depicted in at least three ways:

- At companies associated with ATE programs, site visitors heard more often about courses combined with internships or other work experiences. Those course/work experiences meld students' application of new knowledge with site-relevant experience and building relationships with management at individual sites.
- ATE programs were more likely to train large numbers of current employees effectively and cost- efficiently.
- Companies hiring ATE-trained technicians more often noted the value of the technicians themselves. Companies that hired ATE-trained technicians viewed them as highly qualified and needing little additional training aside from company-specific training they provide to all employees.

Consistently, ATE instruction and student experiences were tailored to industry and company requirements. As evidence that such instruction was effective, the representatives we interviewed noted that they have been able to reduce the amount of in-house training required.

Multiple business and industry representatives reported that a key attribute of community college technician training programs was their ability to respond to companies' needs in terms of courses, curricula, scheduling, timing, and instruction. Whereas this was true at both ATE and non-ATE programs, our findings suggest ATE programs were more likely to have the financial means and impetus to work with multiple businesses and industries to research and assess business and industry needs and skills. ATE sites also seemed more likely to use former company workers as instructors in their training programs.

There was strong affirmation of the importance of knowledgeable and skilled faculty and the inclusion of cutting-edge technology for technician programs. These factors were usually but not always cited as strengths. Generally, findings support the added value of ATE projects.

Business and industry representatives at two ATE sites reported that the technician program had improved the quality of technician instructors or had provided greater opportunities for instructors to improve their qualifications (i.e., update skills and knowledge of current and best practices). At one non-ATE site, company representatives openly stated that college instructors were not sufficiently skilled to take full advantage of new software and equipment provided for their instructional use. Additionally, at the non-ATE site, company college funding was not available to support professional development for the instructors. As described more fully in the Models of Collaboration section, the strength of faculty surfaced as a concern most often when a single college tried to serve a large array of disparate businesses and industries.

Our findings also indicate that the ATE program is substantially stronger than non-ATE programs in producing fruitful collaborative relationships (i.e., providing structure and sustainability). These collaborations can be directly linked to improved quality of technicians. ATE programs appeared more likely to have the financial means and impetus to work with multiple businesses and industries to research and assess business and industry needs and skills. ATE sites also seemed more likely to use former company workers as instructors in their programs. The primary fruits of these relationships were certification course sequences and/or associate of arts degrees serving business and industry needs. Technicians produced by the programs are highly valued by business and industry.

Improving business results. The interviews provided three facets of the community college-business/industry relationship that connect to improving business results: (a) stronger job performance through improved productivity and safety, (b) direct marketing of or for the business, and (c) using collaborations to improve the business structure and sustainability. For points a and b, our findings provided no evidence of an ATE comparative advantage in improving these business results. In fact, the best examples of these results came from non-ATE sites. For point c, ATE projects appeared to produce much better results.

The importance of technician training to strengthening job performance and company safety was mentioned several times. As the description about quality of technicians noted, tailoring instruction to fit industry needs did improve performance. However, the interviews did not explicitly elicit the ways and extent to which such improvements occurred. Neither did the interviews obtain direct examples to substantiate safety benefits. Our tours through the various companies certainly reinforced the importance of safety matters.

Numerous examples were provided to show the marketing benefits for companies. The following two examples are provided:

1. *Local awareness and buy-in*. Some business and industry representatives stated that the local technician-training program had helped increase knowledge about their industry and its importance to the local economy. Thus, they believe the programs improved their marketing opportunities or buy-in.

2. *Targeted marketing for products*. For the two companies that donated equipment and software, the advanced technology made the program more attractive for prospective students, increased students' competitiveness, and provided both companies ample

advertising opportunities for their products. In addition, new or current technicians trained in use of their product were available to customers purchasing these products, thus reducing training costs to the businesses and/or their customers.

We did not initially consider collaboration with and among businesses and industries to be an element of enhancing business results. But, those we interviewed raised collaborations as important to development and marketing. Here, ATE projects seem substantially better than non-ATE programs in producing fruitful collaborative relationships (i.e., providing structure and sustainability). Our findings suggest ATE sites were more likely to have the financial means and impetus to work with multiple businesses and industries to research and assess business and industry needs and skills. ATE sites also seemed more likely to use former company workers as instructors in their programs. The primary fruits of these relationships were certification course sequences and/or associate of arts degrees serving business and industry needs. Technicians produced by the programs are highly valued by business and industry.

Reducing business costs. Business cost savings depended upon the nature of program provided: preemployment or on-the-job training. Preemployment college programs provided benefits such as (a) an initial recruiting filter, a place where good students could be attracted to the industry and poorer ones culled; (b) reducing the number of applicants to be screened for available positions; and (c) reducing on-the-job training after the hire.

Substantial preemployment benefits were found for both ATE and non-ATE sites. At three ATE sites, local companies collaborated in the provision of short-term training or 2-year programs that either were required for hiring or weighted heavily as factors in terms of hiring. At one of the companies, *only* graduates of the local ATE program could be considered for employment. Reduced business costs were also noted above in marketing effects for non-ATE sites where student instruction used the company's equipment.

Both ATE and non-ATE sites noted three major company benefits from subsidized postemployment technician training programs. These were reductions in (a) associated costs for travel, (b) employee training time, and (c) salaries for company-based instructors. For example, at both an ATE and a non-ATE site a local industry council effectively collaborated with the community college's continuing education program to obtain state workforce training grants. These grants shaped the nature of instruction provided, compensated the community college for its involvement, and partially covered the manufacturing companies' participation costs. This arrangement enabled the collaborating companies to get technician training for employees at about one-fourth the cost if provided without outside funding support. This use of federal and state monies was common across sites.

Factors Affecting the Value-Added Relationships

Based on our analysis, multiple, interrelated factors impact community college technician education programs' abilities to add value to business and industries, aside from whether they receive ATE funding or not. These factors are listed and then described more fully.

- Motivation for the collaboration
- The match between businesses' and industries' needs and colleges' abilities to meet these needs
- The economic base of the region where the businesses/industries and colleges are located
- Industry characteristics
- Employee knowledge and skill requirements
- The ability of community colleges to attract and recruit qualified students
- The quality of education/training available to students
- The level of communication between local businesses/industries and community colleges

Motivation for collaboration. Key factors seem to be who initiated the collaboration and for what expressed purposes. We labeled these factors as "push" or "pull" to describe the nature of motivation from the perspective of business and industry. When business and industry sought collaboration with the community colleges to serve internal technician needs, we called it a pull. When the community college sought collaboration with business and industry to serve its education of technicians, we called it a push.

Pull relationships resulted in greater company-perceived, value-added benefits than did push relationships. That is not surprising since in pull relationships, the companies initiate the collaboration with a clear idea of what they hope to gain. In a push arrangement, the colleges have a clear idea of what they hope to gain, but likely a much less clear idea about how or how much the relationship will serve company needs.

Match between business/industry needs and community college needs. When the match was good, the company was likely to require the community college's certification or degree as a basis for employment. Conversely, poor matches yielded little demand for college-degreed or certified students. When a match was poor, companies tended not to hire based on college preparation or require courses as a condition of continued employment.

Economic base. Economic conditions drive business and industry hiring practices. Positive economic conditions are coupled to company hiring of new staff and development of new programs that require upgrading current technicians' skills. Poor economic conditions lead to layoffs or minimal hiring and delays in developing new programs. At the time of our site visits and for approximately the two years prior, the U.S. economy had been in the throes of an economic downturn. Most companies we visited were hiring few new staff and engaging less in programs that called for new technicians or upgrading technician skills. For example, at a non-ATE site downsizing of the manufacturing industry has resulted in a loss of nearly 10 percent of its workforce in the last two years. These difficult economic conditions impinge on the community colleges' collaborations with business and industry, decreasing the short-term technician needs and the need for ongoing or new collaborations that produce them. Often, training and education are not viewed as priorities when companies are struggling to survive.

Like an economic downturn, a shift in the local economic base can depress the needs for technicians and technician education in particular disciplines. At one non-ATE site, the economy of the region is shifting away from manufacturing to white-collar labor; banking in particular was mentioned as the region's fastest growing industry. This shift away from manufacturing and the depressed regional economy combined to reduce the number of available technician jobs while simultaneously increasing unemployment among these technicians. This has resulted in a reduced need for community college-level educated technicians.

Industry characteristics. The size of an industry can substantially affect its technician hiring needs and the nature and extent of assistance sought from community colleges. Large companies often are able to invest more money in programs, need more graduates, and can radically influence technician education by moving their own training needs from remote locations to the community college. When an industry is large enough, it can demand community college courses tailored to its needs. Conversely, smaller industries and companies have less leverage on each of these fronts and less ability to impact the nature of this relationship.

Large companies also may choose to provide their own technician training programs. In those cases there may be minimal involvement with the community college. Yet, even in those instances, the company influences the community college through subsidiary industries. At one non-ATE location, the major industry in the community did not collaborate with the community college. Yet, its specifications for materials, delivered by subsidiary companies in the locale, impacted the skills required in those industries. Those subsidiary industries collaborated with the community college to obtain some technician workshops. Though collaborative arrangements did not include the parent company, certainly the nature of technician instruction provided was based on the parent company's specification expectations.

Just as size matters, so does industry diversity. Industry diversity is generally viewed as a positive characteristic within communities. Yet, homogeneity among industries, especially regarding technician skill needs, provides the best climate for collaborations. The most productive matches between community colleges and companies occurred at ATE sites where multiple companies had similar technician requirements and regularly required large numbers of new hires. In those contexts, the college could develop a program to serve the needs and be assured of sufficient students to make the courses worthwhile. This type of situation occurred at two sites. There, multiple companies had comparable technician requirements that in turn shaped college certification and degree requirements.

As industries become more varied, effectively serving the many technician needs becomes more challenging. The greatest challenges occur when industries' technician needs are heterogeneous and small. Here the college has the difficult challenge to identify technician education programs that serve the variety of businesses and their variable expectations of technicians well. In these cases a business may need to hire new technicians infrequently (e.g., one per year).

For example, at one ATE site, no one industry is sufficiently large to warrant a curriculum tailored to it at the community college. Rather, the local community college's program cuts across mechanics, engineering, architecture, and electronics. Those interviewed across businesses complained of that generalized curriculum and expressed their belief that the college program was not staying up to date or ahead of industry-specific advances. As a result, the businesses did not turn to the college for specialized technicians or operators. Without demand, it is hard to realize value added.

In these diverse industry settings, we also saw less deliberate development of long-term programs and more opportunistic collaborations. Businesses and colleges seem to look for dollars to support direct training (workshops) and then collaborate to provide programs tailored to the state, federal, or other dollars provided. Occasionally, the training evolved into something more extensive than a one-time event lasting several days.

In some diverse industry settings, local advisory boards or cross-industry councils are used as mechanisms to identify viable programs. For example, at two sites multiple companies collaborated through a business council arrangement to identify common needs. Those needs, in turn, were used to gain funding support for a common workshop/course for technicians at multiple businesses. No mention was made at either site of needs assessments to identify long-term needs.

Employee knowledge and skill requirements. Related to the economic base and industry size, technician skill requirements also emerged as a determinant of the value-added nature of local community college programs. When industry-based technician skill requirements are higher than those provided by the community college, the need for college programs drops. For example, at one ATE site nearly all technicians at the three business locations have baccalaureate degrees. Those degree requirements reduced demand for community college graduates.

One way in which community colleges have found a niche in this type of situation is skill improvement. At the site noted, the ATE program very successfully collaborated with one large company to provide specialized software and other technician courses to meet development needs within the company. The program was fairly large, involving about 40 employees in a 2-year course sequence. Company administrators and participating employees were enthusiastic about the program and participants' new/improved skills. Fruits of this program include the following: employees got 25 semester hours of college credit for completing the full program, they learned new software languages required for long-term continued work/employment with the company, they developed an espirit-de-corps working together in the courses, participation in the program is coveted within the company, and nationally it has been rated as one of the best (ranked 14 of the top 100 programs) in this field.

When availability of better-educated technicians is great, that also affects collaborations with the community college. At one ATE site all three companies cited a low need for additional technicians due to poor economic conditions. To make matters worse in terms of collaborations with the community college, the economic conditions had created a glut of graduates with 4-year and higher degrees searching for openings in this technical area. Not surprisingly, many companies preferred technicians with higher degrees.

Recruitment of qualified students. The ability of the local community college technician education programs to attract, recruit, and graduate highly qualified students was of concern to businesses at both ATE and non-ATE sites. Industry representatives at one ATE site complained of high numbers of dropouts and lack of interest or awareness of technical careers. At oneone company a representative noted that its cohort started with 30 students and was down to 10. At a different company a representative stated that the electronics program had 60 students three years ago and now had 15. Lack of a qualified applicant pool and the inability to recruit students to technology programs at community colleges were also factors mentioned by industry representatives in 2 non-ATE sites.

In the locations where student numbers had dropped, several reasons were proffered. Lack of interest or awareness of technician careers was one stated reason. Technical courses also are traditionally viewed as difficult. One company representative noted that students thought the courses were not up to date nor did they provide the "hands on" type of learning they desired. In that situation, where student numbers declined most greatly, the employer was noted for paying low wages. Certainly, making students aware of job opportunities is an important factor, as is carefully matching the learning situation to the desired working situation. However, the other factors—hard work up front with the likelihood of a low-paying job upon graduation or completion—certainly make poor recruiting tools.

Training quality. This factor includes such variables as the quality of curricular materials, the course (program) sequence taken, knowledge/skill of the course instructors, and length of time required for education/training. Respondents typically reported positively about these matters. When concerns were raised about quality, they most often related to how well the program kept up to date, how closely the curriculum fit the company's needs, and length of time required to complete a program.

Those satisfied with the college's program reported giving preference to the program in hiring of new employees. At several ATE sites such preferences were noted and, at one, completion of the college program was required for eligibility to be hired.

When quality concerns were apparent or there was a poor fit between instruction and technician needs, there were corresponding impacts on hiring practices. At one ATE site, company representatives noted that the degree requirements did not provide technicians with all of the skills and capacities sought. These companies preferred technicians with experience to those with associate degrees, although an associate degree was preferred over someone with no experience and no education.

At a non-ATE site, two companies noted their ongoing needs for several types of skilled technicians such as mechanics, machinists, welders, and maintenance technicians. These companies had not brought their needs to the attention of the college or recruit first at the community colleges. Rather, they recruited and hired from existing employers or those with relevant experience.

Communication and rapport. We found communications and rapport between the college program and local companies to be important indicators of perceived value. The value of regular communication was noted by several companies. At a non-ATE company site, business representatives noted that they met regularly with college faculty to develop a plan of action and reach common understandings about the company's gift of equipment to the college. Those meetings were viewed as important for developing trust and a collegial relationship. At a different site, one business representative noted the special and essential role that planning and implementation meetings with the community college play. These meeting are viewed as important to maintaining a strong relationship with his company and its view of the college's graduates.

Strong rapport and a warm relationship between the company liaisons and the college faculty were especially apparent at two sites where collaborative efforts are flourishing. Such positive relationships likely influence recruitment of students, the extent to which curricula are tailored to company needs, and other factors important to long-term success. At another company, the bond appears to be strengthened by the collaborator's regular role as an adjunct instructor at the community college and the community college dean's former work involvement with this company. As noted, these relationships were often coupled with donations of equipment and other expertise to the community college.

Not surprisingly, lack of communication and rapport were evident at locations that saw no value added. The one company that reported no added value from the local ATE program did not make overtures for community college involvement or make it viable for a college to work with it. Importantly, the human resource person was the gatekeeper for such involvement and saw no need for—and possible negative consequences of technicians—taking courses at the community college.

Our findings do not enable us to determine whether good communications and rapport cause added value or result from it. Yet, the constrained ways in which some companies interact with their local community colleges likely reduce the benefits of collaboration. For example, some companies only interact with the college via the continuing education dean. That narrow access point seems to limit opportunities for strengthening ties to technician faculty and their programs.

As noted, communication was influenced by multiple factors: persons involved at the business and college, prior knowledge/relationships, and the respective business and college program needs. Location also seemed to affect overall communications. Site visitors found that the relationship and communication with the local community college's program at one company was enhanced initially by the close proximity of the college's satellite campus to the business's main office. Similarly, another site's local industry alliances seemed to improve the frequency and quality of communication between colleges and businesses.

Models of Collaboration

Across sites we encountered various strategies and relationships, which we coalesced into four models of collaboration. These four models are summarized in Table 4 and are described more fully below.

As Table 4 shows, the four models have many characteristics in common, but the models differ in ways that serve local contexts, local interests, and characteristics of the collaborating groups. The characteristic listed first, regarding who initiates and promotes the relationship, was viewed as particularly important. Models 1, 2, and 3 are clearly driven—or pulled—by the needs of the businesses and industries involved. For example, model 1 was developed largely due to one local company that appeared to play a key role both in the development of the collaborative model and the general perception of worth attached to the collaboration. Similarly, model 2 developed from local companies engaging the local college program to develop and provide customized up-skilling and training programs to their employees. Model 3 is the direct result of companies seeking to enhance the marketability of their products. In contrast to models 1-3, however, the model 4 technician program is pushed by the community college out to local companies.

Scope of education/training tends to be largest in model 4, in part because the program exists in settings that have diverse industry needs. Models 1 and 3 tend to be narrowest because they serve either one company or quite similar company needs. Model 2 focuses primarily on "retooling" people who already are employed as technicians with accompanying degrees or certifications. Model 2 also differs from the others in its tendency toward short-term programs and separation of the college technician program from outreach courses to collaborating companies.

The models also differ in their purposes and nature of benefits provided. Models 1 and 3 are narrowest in their benefits. Model 3 tends to benefit specific companies. Model 1 benefits a specific industry or industry group. Models 2 and 4 provide benefits to a broader array of industries. Model 4, which appears to reach out to the broadest array of industries, also serves in the weakest climate, one in which the technician skills required by various companies vary greatly and demand for technicians is small.

Model 1: Consolidated Industry Model

Key elements of this model include initiation of the relationship by the company or local companies (a pull relationship), a long-term focus/impact on one particular industry (or a homogeneous set of industries), and high concentration of the industry in the geographic area served by the community college. The collaboration between businesses and the college is extensive, keyed to technician needs of a large-scale industry; involves both regular students and employed technicians; and results either in an associates degree or certification. Local companies viewed the collaboration and the resulting technician education program as highly beneficial.

Variations of this model were in place at two sites. At each site, collaborative work and the general structure of the working relationship resulted primarily from one lead company. At one site all companies were part of the same industry. There the lead company initiated the collaborative effort and played a key role both in the development of the collaborative model and the general perception of worth attached to the collaboration. The company had a long community-based history, was well respected locally, and had remained strong despite nationally weak economic trends. Through their own needs assessment, local businesses were able to help the community college establish curricular requirements matched with assessed training needs.

At the second site, the industries were similar to one another (i.e., had similar requirements for their technicians) but produced differing products. As was the case at the first site, initially, the collaboration involved only one company working with the community college.

Table 4. Inferred Characteristics of Business/Industry Collaborations

Collaborative Characteristics	Models of Collaboration			
	1 Consolidated Industry	**2 Retraining/Up-Skilling**	**3 Company Marketing**	**4 Mixed-Industry**
Who initiates or promotes the relationship (pull or push)?	Pull by company	Pull by company	Pull by company	Push by college or mixture of push and pull, with pull from industry council representatives
What is the scope of focus?	Narrow focus on one type of industry and technology need	One general technology area (e.g., telecommunications) with differing need per company	Narrowly focused on one company's needs	Diverse across types of industries and types of manufacturing or other technologies
What educational strategies are employed?	Instruction part of college curriculum	Typically a competitive bid and outside of the college's curriculum—taught by contracted instructor from generic curriculum somewhat tailored to fit general needs; one collaboration produced a course sequence tailored to a business's requisites	Embedded company equipment and software into college curriculum	Internships with industry input to target course preparation of students and short-term workshops outside regular college curriculum
Are there degrees or certification?	Yes, associate degree	Certification directly or indirectly; frequently included certification in targeted area, (e.g., Microsoft servers)	Yes, part of associate degree program	Both—either part of associate degree program or a workshop participation certificate

Collaborative Characteristics	Models of Collaboration			
	1 Consolidated Industry	**2 Retraining/Up-Skilling**	**3 Company Marketing**	**4 Mixed-Industry**
Is it internal or external to college?	Internal	External, typically staffed by consultants	Internal	Internal and external—i.e., staffed by consultants
What is the degree of program continuity?	Long-term (continuing for foreseeable future)	Short-term (e.g., course) to midterm (1 to 3 years)	Long-term	Long-term and short-term/sporadic
Who participates in the process?	Extensive business and college participation—crosses administrators, supervisors and technicians within companies and administrators, faculty, and students in colleges	Human resources staff in the company work with college administrator to determine course needs. Staffing is contracted outside of college. Participants are company employees.	Company administrators, university administrators (college and department), and external consultant identified by company and college faculty in implementation of courses along with college students who take courses; possible use of facility by company for special training needs	Human resource staff; college faculty; some involvement by dean, chair of college, or outreach coordinator, and company representatives Workshop participants are employees.
What are the purposes served by the process?	Specifically develop technicians to serve large-scale industry needs	Improvement of skills among employees of various companies	Development of highly skilled technicians whose skills match a company's specific sales interests	Serves specific educational needs of students for well-established technology position or short-term skill improvement for company employees

Over time the two sites have taken on different characteristics. The first site remains heavily degree oriented. It works primarily with regular students who are seeking an associate degree. Companies employ these students after graduation.

At the second site, the singular focus of the program dissipated as new companies entered into the collaboration.   Additionally, where the first site's program focuses principally on regular students, work at the second site focuses more on employees of the respective companies. The result has been development of certifications that are based on a combination of work and experience. Completion of the program provides certification to the participants. Certification reflects 20 credit hours in a range of fields. Persons possessing this certification gain advantage for advancing at two businesses we visited and is required for advancement at the third.

This strategy provides some of the same benefits to the college noted above. It is a long-term arrangement involving company management and employees and the community college faculty. As such, it has the potential to be an advantageous collaboration for the local technician program. However, the number of technicians hired in the nearby geographical area is relatively low for economic reasons, thus reducing this program's impact.

Both sites report substantial benefits. Both produce skilled technicians that meet local industry needs. Where one site uses the Associate of Arts degree as the basis for hiring technicians, the other used both the degree and certifications.   At both sites the companies save money and time they had previously used for training or re-skilling. In the first locale the companies use college performance as a major criterion in selecting employees. In the second, the certification may serve employment interests, but the program is viewed more importantly for advancement in the company.

Those interviewed reported that the community colleges had more time to concentrate on the educational aspects of training employees (e.g., pedagogy, instructional design) than the company would if it provided in-house training. Therefore, they saw the local community college technician instruction as higher quality and more effective. (Their perceptions may result from the fact that the community colleges often used former company workers as instructors.)

Supporting their statements of value added, businesses noted:

- They currently provide very little of their own on-the-job training to the technicians. Instead, they send current workers to the college program to update their skills.

- They willingly commit substantial time, money, and personnel resources to the program. For example, the industry was quite influential in getting the program started and in providing guidance through oversight and advisory committee membership.

To serve the needs of workers, who also take courses, the companies and the community college have worked together to develop flexible work and course schedules since some technicians work 12-hour shifts.

Model 2: Retraining/Up-Skilling Model

We found this model at two sites. The community colleges at both locales used this general model with all six companies we interviewed. For one of the companies, use of the model varied significantly enough that we describe it as a separate form of this model. In both forms

- Local companies requested services to address in-house training needs to improve or reskill employees (a pull relationship).
- The college was selected to provide the service on a competitive bid basis or as a partner in a request for external funding.
- The college provides one or more courses in targeted areas of employees' needs which, in some cases, lead to certification.
- The community college handles all the administrative aspects of the course (providing instructors, scheduling courses, marketing the course, pricing the course, etc.).
- Instruction is tailored to business needs.
- The collaboration generates revenue for the college. In several cases companies reportedly paid part of the tuition and fees for participating employees.
- Skills taught typically serve specific company needs (e.g., how to use a new software package) and are not likely to markedly improve an employee's marketability.
- Though not usually tied directly to a particular discipline-degree program, course credits could be applied toward a college degree.

Both forms of this model appear to serve the businesses well but likely have quite different effects at the college level. One form, used by one ATE collaborating company, engages the faculty in the college's technician program. The other more typical form, used by all ATE and non-ATE sites does not. Additionally, the two forms differ substantially in the nature of their development work and length of contractual commitment.

The more common form typically called for delivery of single courses or repeated instruction of a single course, with instruction provided by an adjunct instructor. For example, one community college contracted with local businesses for the past 3 years to upgrade the skills of existing workers for new technologies. One such area of training was in MS Office and Oracle. At 1 site, 3 companies were visited; 80 people had been trained during a 40-hour program during the first year. The current course has since been expanded to 68 hours and is presented over a 6-month period. At a second company, interviewees stated the annual benefits they gained were equal to 5 years' worth of training; their IT workforce was reskilled from IBM and UNIX mainframe to Windows client-server technology.

At the second site, company representatives also viewed this typical form of outreach as very effective. There, through its continuing education program, the college leverages state workforce-training grants to enable additional manufacturing companies to participate. These programs, while customized to fit companies' needs, are short term and do not include formal degree or certification programs within the college. They focus on the management and supervision of the manufacturing operations but not on the workers and skilled technicians.

In this form of the model, the college's role is very similar to that of a broker who helps configure the program. The college/business relationship is heavily dependent upon one outreach person at the community college who handles all arrangements for development and implementation of instruction. Also, the program exists outside the main course stream of the college and is dependent upon persons outside the college to deliver the instruction. Instructors employed for the program provided the same "courses" for the other competitive bidders. So, while the relationship with each company was positive and unique, much of the delivered program was no different than that provided by other vendors. Also, since consultants (adjunct instructors) provided the instruction, the instructors likely brought little back to the college to develop college-based instruction skills.

The second form of this model is a variation on the common form that seems unique and more powerful. One college collaborated with two businesses using the typical form but varied the process significantly to serve its collaboration with a third company. Here a large firm contracted with the college to (a) develop a 25 quarter-credit hour curriculum including 6 core courses and (b) educate company staff over a 5-year period. (At the time of the site visit, 40 persons had completed the program.) The long-term contract, extended involvement by college faculty, and the major development work made the arrangement unique. Additionally, college faculty were integrally involved in development and instruction of the program, and the process facilitated the college's development of a curriculum that could be used for other purposes. Although developed as a proprietary program, after 1 year the community college was allowed to "sell" that same program to other interested students and business/industry organizations. The college faculty's long-term involvement, extensive curriculum development efforts, and the right to sell the curriculum likely contribute much greater value to the community college.

This alternative form of model 2 has characteristics in common with model 1. Here, however, the relationship was delimited to one company. Those completing the course sequence gain a company certification (not college) for completion, and completion of the sequence will likely help advancement in the company.

Model 3: Company Marketing Model

The provision of company equipment, software, and facilities upgrades to a community college characterizes this model. In exchange, the community college agrees to use the equipment or software as a central ingredient in the curriculum and may provide the company with direct use of the instructional facilities for limited marketing purposes. The collaborating businesses gain value primarily from an increased supply of technicians who are qualified to use their equipment or software. The companies also gain name recognition and likely tax write-offs for contributions to an educational institution.

Similar to models 1 and 2, this model is initiated by the pull of companies seeking additional markets or new marketing opportunities and is narrowly focused on company needs. The ensuing program has the potential to be long term and results in the development of highly skilled technicians matched to a company's specific sales interests.

From site visits conducted in previous years (i.e., not a part of this study), we know this model is employed at ATE sites. However, among the sites included for this study, only one non-ATE site used this model. At the site visited, the model provided a strong and mutually beneficial relationship between a local community college and surrounding businesses. The collaboration focused on technician education. At this locale, one company donates its equipment to the local community college for use in its machining lab in return for use of this lab as a showroom and training facility. This allows the local college use of state-of-the-art equipment for its courses at a fraction of typical costs. In addition to limited showroom use, the company benefits because students who complete the program have intimate knowledge of the machines and software of this particular company. The company sees this as a way to ensure that a skilled manufacturing workforce is available to its customers; they themselves do not hire technicians. It also hopes this will increase the likelihood that companies will buy or support its machines, knowing that there will be an adequate supply of skilled technicians to operate them.

A software company at the same locale engages the community college as a major instruction site. The company's software is used to control industry machines and the college has tailored entire courses to this software. That company provides the software to the college and trains local instructors at a reduced price. In turn these instructors teach their courses using the donated software. As a result, graduates of the program are certified in the use of this software and see the benefits of the technology. Almost certainly the software company anticipates that technicians who matriculate from this program will be hired by manufacturing companies and will be on-the-job advocates for the use of the software on which they were trained.

The collaborating businesses note the college gained real benefits. These partnerships have helped the college update its equipment, software, and instructor skills, allowing for the transfer of more current knowledge and practice to students. In addition, the whole technician education facility was rewired and physically improved at no cost to the college.

Despite many positive attributes of these collaborations, faculty members' knowledge/skills were viewed as potential barriers to long-term collaborative success. The collaborating companies viewed faculty members as neither sufficiently skilled nor up to date on technological trends to instruct students in the more sophisticated capabilities of the new equipment and software. It appears likely that the businesses involved will put substantial pressure on the college and its faculty to improve the knowledge and skills of faculty for those courses.

Model 4: Mixed-Industry Model

In this model the college works with collaborating businesses to tailor coursework and internship experiences that serve its students and meet business/industry needs. Colleges employ this model to reach out to diverse industries, each of which requires relatively few new technicians on a continuing basis. The community colleges typically provide these technician programs as part of an associate degree program or as separate certificated short-term workshops. Because the college reaches out to the businesses, it is viewed as a push type model. We visited four sites that use this model; implementation occurred in much the same way across all four.

At each site a local technician program provided course/internship instruction or short courses for multiple industries. As implemented, each college requested collaboration with a company to serve student needs. No company could accommodate many students, and each company's technician needs varied from the others. At one site, collaboration led to college-based review and restructuring of courses to serve industry needs. At another site, one company was using its collaborative arrangement as a means to implement courses outside technician education.[ID as ATE or Non ATE]

Companies' judgments about these programs varied from positive to negative with persons from several companies reporting that their company saw little or no value in the program. Where the program was viewed positively, respondents believed the college faculty to be strong. The converse was true as well.

Representatives of two companies noted as strengths that the program serves both awareness and filter roles. For example, a representative from one company viewed the program as a first step to get students interested in the occupation (although on average they hire only 1 new technician a year). A representative from the second company saw the main use of the program as a screening device to weed out people unsuited for the working conditions.

This model more than the others appears to be significantly affected by local economic conditions. At several sites company representatives stated that their need for employees was declining. Those economic conditions also increased the availability of baccalaureate-degreed people. The combined factors make it more difficult for students with associate degrees to gain employment, exacerbating collaborations with companies and recruitment of students.

Conclusions and Recommendations

Through this study we sought to determine whether the ATE program adds value to business and industry. We conclude that indeed it does. Our determination is based both on direct responses from representatives of business and industry and a contrast of responses from representatives of companies that had participated in the ATE program with representatives that had not. Respondents from ATE sites directly and consistently stated that their relationships with the ATE program added value in one or more of four general ways: (1) the numbers of technicians educated/trained and available, (2) the quality of these technicians, (3) improved business results, and (4) reduced costs for business.

Comparison of findings from the ATE and non-ATE sites serves to strengthen the direct response findings from respondents. Consistently, these findings favor the ATE program in these ways: communications and collaborations across business and industry groups, capability to respond quickly and effectively, quality of instruction, numbers reached through the program, greater attention to faculty development in areas of business and industry needs, and matters of financial means and impetus.

All college sites appear to have employed similar models for engaging with business and industry. Altogether we identified four models. Of these four, three models were employed at both ATE and non-ATE sites; the fourth, company marketing, we observed only at a non-ATE site. As noted in the findings, each model had its own strengths, weaknesses, and dependencies on the local context.

In initiating the study, we viewed the matter of value added through three general questions. Now we return to those questions and address them primarily from a model's perspective. Here our focus is on addressing ways in which the community colleges use the various models to provide value to business/industry, rather than on comparison between ATE and non-ATE sites.

How and to what extent do local community colleges serve industry's technician workforce needs?

At the sites visited, colleges employ four strategies (models) to serve industry technician training needs. While we noted unique strengths and weaknesses of these models in our findings, there is overlap in the following methods across the four models.

- All include substantial collaborative arrangements between the companies and the colleges to serve development of technicians.
- All provide technician education and training as course-based opportunities.
- All provide degree and/or certification program options for participants.
- All provide proximal and hands-on instruction. All but the company marketing model included mechanisms to provide at least some instruction to students on site at a company or in close proximity to participating companies. The company marketing model made its equipment and software available on the college campus.
- The consolidated industry and company marketing models engage in substantial curriculum development and use of full courses for teaching aspiring technicians prior to their joining the workforce.
- The consolidated industry and mixed-industry models engage students in internships serving the needs of collaborating companies.
- Company employees, as instructors, were found in three models (all but company marketing).
- All but the retraining/up-skilling model involve the college faculty members integrally in matters of instruction.

Consistently these methodological points of commonality were viewed as strengths of the respective models. Even with these points of commonality, there is considerable variation in use both within and across these models. One of the perceived strengths of the ATE program was the many ways in which the educators engaged collaboratively with the business and industry representatives to tailor the models to fit local situations.

We have one caveat on what we generally viewed as strong collaborative practices employed by the ATE program. That caveat regards the retraining/up-skilling model and its limited involvement of college faculty. We address that concern more fully below.

The extent to which the colleges serve industry is heavily dependent on local contexts and collaborative arrangements. Where there was commonality in industry and needs in the locale, the program could be narrowly focused on an industry and provide extensive service, tailored courses, internships in targeted areas, and improvement of faculty to better teach key courses.

Where the company used the college as a marketing tool, the college gained state-of-the-art equipment and materials (huge monetary support). The companies in turn gained substantial access to the college, opportunities to use the college as a showcase, and large numbers of students receiving in-depth instruction on company equipment.

Where companies had limited needs for new technician employees but desired increased skill among current employees, workshop and special courses were matched to company needs. These matched instructional programs tended to be limited in duration but with good potential for impact at the participating company or companies.

Where industry needs were diverse in the locale with only small technician needs per company, the extent of service to the companies tended to be smaller. In those situations, internship programs appear to be favored as a collaborative tool. Representatives of several companies spoke positively of internships as a recruiting tool for the company, as a strong educational tool for the interns and associated employees, and as an important mechanism for maintaining contact with the college—though with stress related to supervision.

At each site, we heard anecdotes regarding persons who were engaged both in the industry and in courses or workshops and how that involvement changed things for the better at a company. Common to these anecdotes were descriptions of how what the students learned in courses was shared on the work floor and incorporated into company practice. These anecdotes reveal an important attribute—the instructional programs do reach beyond the persons who receive instruction. Those touched by the courses, in a sense, infiltrate the companies to change behaviors and practices.

What are business and industry needs for community college-prepared technicians, both in terms of numbers of technicians and technician knowledge and skills?

Because of the U.S. economic downturn, there was much less demand for new technicians than we anticipated. Few companies were willing or able to provide clear statements of their needs for more technicians. Just 6 of the 24 companies listed *increasing the supply of technicians* as a reason for their involvement with the college. Company representatives most often referred to the recent downturn in the economy and surrounding layoffs when increasing the supply of technicians was not important to the company.

Two of the described models, consolidated industry and company marketing were the dominant modes for serving industry-based needs in technician demand situations. The two models serve different objectives. The consolidated industry model works collaboratively across companies in a single industry and with the local college. The company marketing model occurred via a unitary agreement between a well-placed community college and a large company. Both models produce courses tailored to serve the collaborating companies. The consolidated industry model, however, appears to be broader in scope—providing degree and certification options and serving the needs of multiple companies. In each of the company marketing cases, we found that the company collaboration produced technician skills in a single area, albeit one in high demand and at the cutting edge. Also, increasing market share was a clear objective of the collaborating company in the company marketing model.

Even when increasing supply was not important, company representatives view the colleges as a continuing source of technicians for their company needs. As a continuing educational source, these ATE projects also serve a crucial filtering role for companies. With colleges teaching students in the skill areas desired by the companies, the companies note that they can rely on the college faculty to identify students who are sufficiently knowledgeable and skilled to meet company requirements. This reduces company training costs while providing the company with an overall stronger technician workforce.

Because demand for skilled technician had dropped substantially in almost every sector during the past two years, companies placed nearly as much emphasis on the retraining/up-skilling of current employees as on degree and certification instruction for students hoping to enter the field.

The retraining/up-skilling model was most used to serve companies' needs for improving technician skills, though the consolidated industry model also provided opportunities for current employees to enter the college program to improve their skills and advance within the company. Company representatives were quite positive in their valuing of both program efforts and indicated that these efforts did improve the quality of their technician workforces. We observed one especially strong retraining effort where the company worked with the college to develop curriculum and upgrade technician skills over a several year period. That program was unusual in its extensive involvement of college faculty, the development of specific courses to serve company needs, and the long-term engagement of company staff members in the program. But, it clearly demonstrates the retraining/up-skilling model can be conducted in ways that serve development of the college's capabilities while providing benefits to the company.

Despite such strong statements of support for the retraining/up-skilling model, we retain concerns about the way it was typically used at ATE and non-ATE sites. Most often this model was implemented through what we termed a college-broker approach. As implemented, a college administrator made contractual arrangements for the course and used external staff, nonfaculty members, to provide instruction. In that context, three factors reduce its value as an NSF-supported model. First, the college gained only financially. Neither its curriculum nor its faculty was integral to preparing and teaching the courses. The result is that process does little, if anything, to develop the college's faculty and technician programs. Second, other federal and state funding programs serve companies via this model. For example, at one non-ATE site a company representative stated that federal support was sufficient to cover approximately 75 percent of the costs for such instruction. Third, many other organizations (e.g., for-profit companies) can do this job well, if not as cheaply as the colleges. For those reasons we recommend against use of ATE funds to support the retrain/up-skilling model where the community college serves just a broker role for delivery of training services.

In what ways can business/industry and community colleges better collaborate to improve preparation of technicians to serve identified workforce needs?

This question is perhaps the most difficult to answer. It presumes that collaborations can be fine tuned to produce better results. In many respects our answer is that the ATE program has made substantial strides in increasing collaborations between community colleges and the business/industry counterparts. The program has also provided new impetus and ideas to improve the results from these collaborations for improving the technician workforce. While we are confident that many things can be done to improve the program, we also know that oftentimes well-intentioned changes make matters worse. With that caveat, we have provided several suggestions.

Across all sites, the substantial influence of who "drives" the collaboration and whether it is college or industry instigated stands out as a major indicator of success. Internal company drivers (i.e., needs internal to businesses or industries) provided greater incentives for successful collaborations than external drivers or factors that emanated from the college's perspective. Therefore, how colleges can get business/industry to ask for help becomes an especially important matter. This means it is important for the college to come to the companies not with a stated method (e.g., internship) they want to impose but with questions regarding what are the company's technician-based needs and how can the college engage with them to serve the needs. Needs assessments, where college staff actively seek information from businesses regarding technician needs and strategies for serving such needs, can be used to good effect in these situations.

The mixed-industry model best exemplifies the college instigated collaboration. In a mixed-industry situation trying to serve the many disparate needs likely requires careful balancing to ensure that the college can respond in viable ways. We encourage engaging the local advisory committee to sort through these disparate needs to focus collaborative work and best serve the industries. Certainly, these committees are uniquely positioned and likely most qualified to address these issues.

Though most evident for the company marketing model, representatives regularly spoke to the need for and importance of highly knowledgeable and skilled faculty. Consistently, respondents wanted local faculty to increase their knowledge and skills in ways that would better serve their technician needs. One of the reasons the companies liked to have their own staff teach technician courses was because they were confident in the skills of those teachers. Yet, just as local contexts drive the models employed for collaboration, they also impact expectations for faculty development. In the consolidated industry model the homogeneous industry base calls for in-depth knowledge of that industry and its many technician demands. The company marketing model also requires in-depth knowledge of a special technical area and its associated equipment and software. The mixed-industry model calls for broad technician knowledge crossing several industries and likely in-depth knowledge for individual industries as well. Certainly, the demands for faculty knowledge and skill are greatest in the mixed-industry model.

The ATE program already focuses heavily on faculty development. But, the specific interest in increasing local college faculty members' knowledge and skills bears careful examination from several perspectives. First, in almost every case, the number of faculty members affected is small—too small to be a basis for a local faculty development workshop. Second, this type of development requires that either an expert or experts be brought to campus or that the specific faculty members go to other locations to gain the requisite skills. Both likely carry substantial costs on a per person basis. Third, when the faculty members do gain the desired knowledge and skills, by whatever faculty development method employed, these individuals are likely to be highly marketable and may move from the college. Thus considerable investment may yield relatively little local benefit. For those reasons it likely is difficult for the local community college to justify spending its resources on this type of faculty development.

Yet, given the national interest in improving technician skills, this seems particularly well suited to ATE aims. We believe the findings support a continued ATE emphasis on faculty development and especially encourage an emphasis on developing faculty skills in areas important to local technician demands. Where commonality in skill development can be established across sites, we encourage the sites to join together to construct and conduct institutes or other means to effect these types of faculty development.

In addition to common methods, we noted three attributes that flow from the four models:

- Strong communication/exchanges between local businesses, industries, and the college programs (business/industry personnel acting as adjunct faculty, involvement of business persons on boards, etc.)
- The capability of the local community colleges to both understand and meet local business and industry needs (collaborations via local business councils appears to be a good way to develop and increase this understanding)
- The presence of mutually beneficial relationships between businesses, industries, and the local college programs (e.g., providing machines to the college in exchange for being able to use the college lab as a machine showcase)

Certainly, the ATE program has fostered development of these attributes and they serve well the value-added intentions of the program. We encourage the ATE program to continue fostering them.

Finally, we note the importance of fiscal viability. While we sought only to address matters of technician demand (numbers) and quality, company representatives noted that reduction in company costs and ability to meet marketing objectives also serve as powerful inducements to collaborate. Objectives of the ATE program are neither reduced costs nor company marketing. Yet, we concluded that both serve as intervening variables, promoting the stated aims of the ATE program. We do not encourage ATE support to reduce business costs or to improve their marketing capabilities. However, when these variables encourage business/industry involvement for reaching ATE objectives, we believe they should not be viewed as barriers or hindrances to ATE support.

Ultimately fiscal viability boils down to company profitability. At every business we visited, company representatives spoke to the importance of producing a profit for its stockholders or owners. Engaging the college to improve the working conditions for employees, increasing safety, making them more skilled in their work, and raising the productivity on the work floor were all points mentioned as important. Yet, these representatives always finished by saying in one way or another "but we have to make a profit." This means that the individual colleges and ATE must remain mindful that profitability is and likely will remain the most important criterion used by companies to determine the viability of their technician education collaborations with a community college. Perhaps the greatest challenge to ATE and the community colleges is how to best orient and use that interest in profits to serve improvement in technician education at the community colleges.

APPENDIX A

Assessing the Value Added by NSF's ATE Program: Business & Industry Perspectives

Team Packet

Assessing the Value Added by NSF's ATE Program:

Business & Industry Perspectives

Team Packet

March 24, 2003

Team Packet Index

Background Information

The ATE Program

The ATE program grew out of a national interest in a balanced approach to developing and using technology to meet the nation's educational and workforce needs. The two primary goals of the ATE program, a Congressional mandate, are to (1) produce more science and engineering technicians to meet workforce demands and (2) improve the technical skills and the general science, technology, engineering, and mathematics (STEM) preparation of these technicians and the educators who prepare them. NSF initiated ATE to address the Congressional mandate, and this program was created in the Education and Human Resources Directorate (EHR). ATE is co-managed by two Divisions, the Division of Undergraduate Education (DUE) and the Elementary, Secondary, and Informal Education Division (ESIE). Additional information about the ATE program is available at http://www.ehr.nsf.gov/ehr/due/programs/ate/.

ATE focuses its funding efforts at the community college level, with outreach to secondary and baccalaureate institutions, in order to strengthen and expand the scientific and technical education and training capabilities of individuals at these institutions. ATE set priorities for what types of work would be supported and how it would allocate funding. The objectives (i.e., drivers) of the ATE program are:

- Develop model instructional programs in advanced-technology fields (program improvement)
- Provide professional development of faculty and instructors in advanced-technology fields (professional development)
- Establish innovative partnership arrangements (collaboration) with associate-degree- granting colleges, secondary schools, colleges/universities, businesses, industries, and other appropriate public and private sector entities that need skilled technicians in their workforces
- Develop and disseminate instructional materials (materials development and dissemination)

The WMU Evaluation Project

NSF funded the evaluation project at The Evaluation Center at Western Michigan University (i.e., the WMU evaluation project) to assess the impact and effectiveness of the ATE program in 1999. This evaluation addresses 4 basic questions important to ATE and its stakeholders: (1) To what degree is the program achieving its goals? (2) Is it making an impact, reaching the individuals and groups intended? (3) How effective is it when it reaches its constituents? (4) Are there ways the program can be significantly improved? In its three years of work, the project has collected and provided evaluative information and judgments in all these areas.

The project has employed two primary mechanisms to gather data, a web-based survey and site visits. ***Additional information about this project and its findings and recommendations may be found at http://ate.wmich.edu.***

Study Design

Assessing the Value Added by NSF's ATE Program: Business and Industry Perspectives

Synopsis of Agreement Points Based on Preliminary Drafts of the plan:

- The study will address accountability of the ATE program in terms of its impact on the business and industry workforce.
- Data is to be gathered from Business/Industry representatives rather than ATE project staff members or ATE students (Substantiation information may be obtained from ATE project sources).
- While the ATE program includes secondary, 2-year, and baccalaureate institutions, this study will aim at the impact made by 2-year institutions (community colleges).
- Within community colleges the evaluation will focus on the impact of ATE-based and supported technician programs. This means that our study will sample from those ATE projects that list program improvement as part of their project expectations.
- The study will first gather data from businesses and industries in five community locations where NSF program officers judge the projects to be exemplary in their productivity (the five sites are to be selected by NSF). We anticipate that interview data will be collected from as many as four businesses or industries in each of these selected communities.
- Data will be gathered from businesses and industries in five comparison sites. These five sites will be identified through interviews of the business and industry representatives. These comparison sites are to be communities in which these same industries (or comparable industries) are located. However, the comparison sites (and businesses and industries in those communities) will not have ATE-based programs serving them.
- Findings from this study of the 10 sites will be used to determine whether data will be gathered from additional sites. Determination of this next step will be made in consultation with NSF staff.

Study Purpose

This study addresses whether or not the ATE program adds value to the technician workforce serving business and industry. Added value is operationally defined in terms of two elements. First, more technicians are produced. Second, these technicians are better prepared.

Working Hypothesis: The ATE program adds value to the business/industry technician workforce.

We will present this study to business and industry representatives as a study of community college-based programs serving technician workforce needs in their companies. From the business/industry representatives we will seek to learn (a) what they see as their needs for community-college prepared technicians [in terms of numbers of technicians and technician knowledge and skills], (b) to what extent and how the local community college serves their technician workforce needs [including satisfaction with the current technician-based program at the community college], and (c) ways in which business/industry companies and the community college systems can better collaborate to improve preparation of technicians to serve their identified workforce needs. [***Only at the close of the interviews at ATE sites will direct questions be posed about the ATE program, if the ATE program was not described in answer to the three primary points.***]

Study Design

Because there is a belief that the value added by ATE projects will be hard to identify and document, this study is to move forward in stages. Initially, the study will focus on those ATE projects that NSF staff perceive to be the strongest (i.e., are most productive). Only if the findings from this preliminary study yield positive findings will a more complete study of all ATE projects be conducted. The design presented below pertains to this first stage.

Data will be gathered from businesses and industries that collaborate with community colleges. Both ATE-based collaborations and non-ATE based collaborations will be included. Three to four businesses and industries at each of five ATE-based sites (communities) and one or more business and industries at each of five non-ATE sites will be included in the study.

From interviews of all businesses and industries representatives we expect to document the nature of collaborations between community colleges and business and industry for preparation of technicians and whether in the view of business and industry these collaborations improve the quality and number of technicians prepared to serve the business/industry (B/I) workforce needs. These data will answer the questions of what and how much impact the collaborations with community colleges produce to serve their technician workforce needs.

Data collected from the business/industry representatives, that are known to have collaborated with an ATE project, will describe how their technician workforce has changed through collaboration with the project. For example, they can attest to availability of technicians and their qualities prior to the ATE (NSF project) collaboration contrasted with the current situation. To more fully and unambiguously answer the question of what would have been different (how things would have changed) if ATE funds were not available, we will compare findings from ATE and non-ATE sites.

Target Population and Sample

A standard practice in evaluation efforts is to triangulate information by soliciting data from independent stakeholder groups. In previous project-based studies we have asked ATE project staff and students about project work and productivity. This study triangulates findings with the previous studies by gathering data from business and industry people (human resource staff, technician supervisors, and coordinators for community college collaborations).

We will start with a list of 5 projects/centers provided to us by NSF. These are “exemplars” in the ATE program– projects that are perceived to be most successful in meeting the technician needs of business/industry (purposive sample of exemplars). These projects should be in existence for at least 2 years, well viewed by NSF (e.g., strong collaborations with business/industry as evidenced by NVC reports), and represent a variety of disciplines in the ATE program (e.g., IT, Biotech, Chemistry, Manufacturing), if possible.

We will identify businesses and industries to contact by communicating with members of the respective project advisory committees and from project survey responses to our request for business and industry persons who are collaborating with their projects (We will determine the advisory committee names via a project’s Web site or ask a project directly). As a courtesy, we will let these 5 projects know that we may be contacting some of their business/industry partners.

From the business/industry interviews at each site we will seek to identify one or more comparison companies. Persons interviewed will be asked if they know of a similar business/industry (name, city, who to contact, permission to mention name) in a different community. From those communities identified we will select at least one business/industry to include in the comparison sample. A requirement of such comparison companies is that they collaborate with a community college that does not have an ATE technician program (defined as a project in existence before October 2002).

This selection strategy is a means to achieve comparability between ATE and non-ATE business/industry institutions in a reasonable yet viable way. For example, if we talk to the plant manager at Koch Industries in Corpus Christi, we will ask him to give us the name of a plant manager in the refining business that is not working with an ATE project. This approach does require that we sample ATE-based business and industry representatives that have industry locations (or competitors) at sites where there is no ATE collaboration.[1]

In all the businesses/industries visited, we will interview several people. Our target population of persons to interview is those persons who are knowledgeable about the community college collaborations, technician needs, and/or technicians' competencies/skills. These individuals could include individuals in the "Human Resource Development" units and/or those persons that B/I assigns to work with the community colleges (e.g., members of advisory committees). Within individual companies, second and third level sources will be technician supervisors and technicians themselves. We will also review documents obtained through these interviews, when appropriate, looking for evidence of impact.

Procedural Steps

- Preliminary interview forms are currently being constructed based on both the questions/hypotheses posed above and a focus group meeting we held with business and industry representatives in Kalamazoo, Michigan.

- The initial sample of 5 projects has been requested from and provided by Dr. Salinger.

- From this list, we will choose 2 sites to be visited concurrently. Two separate teams of evaluators 2-3 persons in size, will conduct interviews. Each team will visit one community site and conduct interviews at up to 4 businesses/industries over a 1-2 day period. From that initial site visit a second comparison community/business location will be identified. The study team will then arrange and conduct a second site visit to conduct interviews at the comparison location.

- These four initial visits (2 with and 2 without ATE) will be used to refine both the sampling strategy and interview protocols. At this point appropriate members of the Advisory Panel and perhaps the focus group members from last July as well will be called upon to provide feedback. These revised materials will be used to prepare for and conduct the remaining site visits.

- The unit of analysis (n) will be each business/industry location (not the number of interviews conducted at a business or industry). We anticipate that the sample size will be approximately 20 for ATE-based projects and 5 for non-ATE projects. For each of the 5 ATE sites we hope to visit as many as 4 businesses/industries, resulting in an n of 20. For each of the 5 non-ATE sites, we

[1]The proposed sampling plan cannot be termed equivalent in a random sample sense. Yet, it does provide a viable comparison group based on common features of those companies that collaborated with ATE projects at community colleges and those that collaborated with community colleges that did not have ATE funding.

likely will visit only one business or industry resulting in an n of 5. While it could be beneficial to visit 20 non-ATE sites, in practical terms (access issues, cost), it would be more realistic to visit 5. At each of these business/industries, we will interview multiple individuals and converge data from these interviews into a single data record (While the resulting sample size is too small to provide a powerful study in statistical terms, the rich data obtained from the interviews should provide good indicators of effects that are likely to exist).

- We will prepare a report based on the 10 sites to assist us in deciding whether or not to move on to interviews with a larger, perhaps random, sample. Determination of this next step will be made in consultation with NSF staff.

Procedures

Overall Time Line

* **5 ATE Sites Provided by NSF—**early January (NSF)

* **5 ATE Sites Contacted to Verify and Update Business/Industry Contacts and Provide Updates—**January-mid February (Co-PI/Project Manager [Nanette Keiser] and Projects)

* **5 ATE Site Visits Scheduled, Course Catalogs for Local Colleges Collected** (Research Assistant [Danielle Maurer])**, Procedures/Protocols Drafted—**January-February (Co-PI/Project Manager)

* **Letter Obtained from NSF for Use with Non ATE Sites**—February (PI, NSF)

* **If Possible, 5 Non ATE Sites Identified and Visits Scheduled** (Co-PI/Project Manager) **and Course Catalogs Collected for Local Community Colleges** (Research Assistant)**—**February

* **Protocols Reviewed and Refined** (All—i.e., PI [Arlen Gullickson], Site Visitors) **and Finalized** (Co-PI/Project Manager)—February, March

* **Initial 2 ATE Sites Visited—**Early April (3-4 businesses at each site) (Teams)

* **Initial 2 non ATE Sites Visited—**Mid April-May (1-2 businesses at each site) (Teams)

* **Adjustments to Protocols Suggested** (All, perhaps some Advisory Panel members) **and Made** (Co-PI)—mid-end April

* **Additional 3 ATE Sites Visited—**Late April to May (3-4 businesses at each site) (Teams)

* **Additional 3 non ATE Sites Visited—**May (1-2 businesses at each site) (Teams)

<u>For Each Visit</u>

* **One-Two Weeks Prior to the Site Visit** (Evaluation Project Staff)

Team Packets are emailed to team members 1-2 weeks before the site visit. This packet includes the items in this document plus:

- Site Contacts/Arrangements
- Photo Release (this may be sent in advance as well)
- For ATE sites, abstract for project from which the referral was made
- Course catalog for the local community college (to team leader only)

* **Two-Four Days Prior to the Site Visit** (Evaluation Project Staff)

Driving directions and phone contact information are provided again to team members via email.

Team member information and a reminder to the site are provided via email.

* **Site Visit Occurs Over 1-2 Days** (Teams)

For ATE sites (usually 3-4 businesses), site visitors will fly in the night before the first visit and spend 1-2 days on site, usually ½ day at each business/industry. While at a business site, all team members will usually initially meet with the site contact and then split up to interview, observe, take pictures, and collect documents.

For non-ATE sites (usually 1 business), site visitors will fly in the night before the first visit and spend ½ day on site. While at a business, all team members will initially meet with the site contact and then split up to interview, observe, take pictures, and collect documents.

*** One Day After the Site Visit**

Thank you is emailed to the site by evaluation project staff (initial and ongoing contact for the evaluation project—was Co-PI/Project Manager) and team leader.

Reminder emailed to the team leader that his/her report is due 14 days from the site visit (Co-PI/Project Manager).

*** Fourteen Days After the Site Visit** (Team Leaders and Members)

Co-PI/Project Manager receives site visit report via email from team leader. Will contact team leaders with questions, when needed.

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* **Over the Course of the Study—April-July** (PI, NSF, Teams, Others)

Report development includes data entry, synthesis of data, and the development of the report. This effort will be led by the PI with involvement by both data collection teams and others. PI will finalize the study report and provide a draft to NSF for feedback. PI will finalize the report, and the report will be posted to our Web site, with an email to participating projects and business/industry contacts.

Helpful Hints for Site Visit Teams

These are based on our experiences with the site visits to date.

- Fly in the night before or arrange to have at least one person that does to ensure coverage. Plan to fly out the morning after the last site visit, if possible. Again, have at least one person that can do this.
- Try to have all team members stay at the same hotel
- Meet at the hotel prior to the site visit to organize who will be covering what items. Decide who will be primary on which interviews (One person ensures all questions are addressed. Others jump in as needed). It's helpful to have the Team Leader be primary on the Business/Industry Collaborator (initial ATE contact or contact provided by ATE site for non ATE site)
- ***Share the attached goals (site visit purposes) with the site and everyone you interview***
- ***Ask the business/industry collaborator to leave the room while you're interviewing technicians, technician supervisors, human resources, and others.***
- Exchange business cards with interviewees (or record contact information on interview forms). The Team Leader will need to track this for the report (Section I—see Site Visit Report Outline on pp. 13-14)
- Change the site's agenda to ensure that you are obtaining the information you need (e.g., ask the site to call individuals for interviews while you're there if individuals are not available to be on site during the visit)
- Debrief periodically during the site visit (assign sections of the report) and at the end of the site visit, including dividing up the report writing (see procedure on pp. 10-16). Team members also provide general impressions/thoughts, including capturing stories of those interviewed (e.g., technicians). These are emailed to the Team Leader shortly after the site visit.

Goals of ATE Evaluation Site Visit (Site Visit Purposes)

Please share these with everyone you interview via the brochure.

- ***For the National Science Foundation, we are studying community college-based programs serving technician workforce needs. We are visiting several businesses/industries that have collaborative relationships with their community colleges.***
- ***From your perspective (business/industry),*** we want to learn about (a) what you see as your needs for community-college prepared technicians [in terms of numbers of technicians and technician knowledge and skills], (b) to what extent and how the local community college serves your technician workforce needs [including satisfaction with the current technician-based program at the community college], and (c) ways in which business/industry companies and the community college systems can better collaborate to improve preparation of technicians to serve their identified workforce needs. [***Only at the close of the interviews at ATE sites will direct questions be posed about the ATE program, if the ATE program was not described in answer to the three primary points—don't mention ATE.***]

  For technicians, we want to learn about (a) their perceptions of the demand for their type of position and the skills/knowledge needed, (b) their perceptions of community college technician preparation programs as related to their present position—extent to which appropriate skills and knowledge provided, what is needed, etc., and (c) in what ways the community college program could better collaborate with this particular business/industry to serve the needs of technicians.
- We wish to talk to people, observe activities for technicians, take some pictures, and review any documents that you think would be helpful regarding your collaboration with the community college in regard to technicians (or for you as a technician). You have provided us with some documents.
- ***Only aggregate (across sites) findings will be reported to NSF or anyone else. Neither the names of the businesses/industries nor the individuals interviewed will be listed in any reports.***
- ***A report of our study will be posted to our Web site (ate.wmich.edu) and we will email the [B/I site contact] when this is ready***

Site Visit Process/Reporting

Key Points for Site Visitors

- The site visit procedures and protocols are intended to be guidelines **that show you what types of information should be collected and from whom**. Please rely on your judgment to adapt these to a specific site. **For example, questions from multiple forms may be appropriate when interviewing a business/industry collaborator who is also a human resources contact (function vs. job position title). Notes may be taken on the forms directly or in any other convenient manner.**

- Not all data need to be collected in formal interview settings. **It may be helpful to collect data informally throughout the day and ask the remaining questions during formal interviews.**

- The audience for the Site Visit Report is the evaluators at Western Michigan University. *NSF will receive aggregate information from across the sites only.*

- The site visits are intended to highlight different perspectives. **The site visitors themselves bring different perspectives to the evaluation of the site, and each instrument is designed to gain different participants' perspectives. If a question on one of the questionnaire forms will not provide a new perspective, it is not necessary to ask it.**

- Site visit team members should use their expertise to provide evaluative interpretations.

- Site visit team members need to collect stories (e.g., how the business/industry has worked with a community college to improve technician education)

General Site Visit Plan

Each study team consists of 2-3 individuals with varying areas of expertise (e.g., evaluators, business/industry, technician preparation). The Co-PI/Project Manager will provide information to the study team about specific sites including contact names, schedules, and other information (e.g., course catalogs). This information will be mailed in advance whenever possible (please see the Overall Time Line on pp. 3-6).

The PI and Co-PI/Project Manager have designated one person as the team leader. **The team leader will be responsible for coordinating the site visit activities, ensuring that all activities are conducted by someone from the team with the appropriate expertise, and for finalizing and submitting the site visit report.**

Visits will last one to three (most are 1-2) days depending on the number of businesses/industries to be visited. The questionnaires are provided to help cover all of the issues involved in the site visit. **They will need to be modified and/or adapted as necessary to the specific nature of the site and circumstances.** Sites will be prepared to present their data their way, and the information should be recorded as they present it rather than forcing their comments into a particular interview schedule. For example, many of the business collaborator questions may be answered in the typical presentation. As the business collaborator speaks with the study team, the evaluators should be filling in or considering the business collaborator interview questions. Additionally, some of the interviewees may fall into several different interview categories. Combining questions from the various questionnaires would be appropriate under these circumstances. ***To reduce burden on the interviewees on the advice of a focus group of business/industry representatives, we have limited the length of the interviews to 45-60 minutes and 10 or so questions.***

Site Visit Activities

1. Team Meeting for Planning – The study team should meet to plan procedures prior to the visit. This may occur by phone a few days before the visit or in person the evening before the visit.
2. Drive Through/Field Notes/Observations/Pictures/Document Collection – On the drive to the site (business/industry), please write observations about the surrounding community, and when upon arrival at the site, describe the business/industry. Each member of the study team should fill out a field notes form and share it during the debriefing (#5 below) with whoever is writing the relevant portion of the site visit report. With the proper permissions (release forms), pictures of individuals interviewed and activities should be taken. Course catalogs for the local community college programs will be collected ahead of time. Members of the team need to collect the business/industry information related to the collaboration with the local community college and about the business/industry itself, whenever possible. One set for the team leader is sufficient.
3. Business/Industry Collaborator Presentation/Interview – The business/industry collaborator will be asked to give a brief overall of his/her collaboration with the community college near the beginning of the visit, followed by his/her interview. Please take notes during this presentation, considering the questions from various interview schedules that may be answered.
4. Interviews/Observations – Divide up the interviews, observations, and picture taking. Interviews and observations should be matched to the expertise of the site visitors, whenever possible. For example, the visitor with expertise in manufacturing would conduct the technician (in this case manufacturing) interview. It would be helpful if the business/industry collaborator was not present when others are interviewed, although this is not necessary. This collaborator may inadvertently mention ATE. These interviews should take no longer than 30-45 minutes each.
5. Debriefing - At the end of the visit, the study team should meet again in person or by phone to verify impressions and make sure everyone knows what he/she is supposed to write.
6. Site Visit Report – See pp. 10-16

Data Collection

The agenda from the site outline the evaluator activities at the site and, therefore, the data collection forms needed. **Adjustments may be necessary upon arrival at the site**. The packet and list below contain all the questionnaires that might be needed.

Field Notes, Observations, and Document Collection : see Site Visit Activities, Item #2 for detailed information.

Critical Questions: Whenever possible, please try to ask all the questions on the appropriate questionnaire form (e.g., Business/industry collaborator, technician supervisor, human resources, technician). However, when there are time constraints, please be sure to ask this set of questions that will assist you in writing the site visit report (p. 19).

Questionnaires—Business/Industry Collaborator, Human Resources, Technician Supervisor, Technician: Our target population of persons to interview is those persons who are knowledgeable about the community college collaborations (see Business/Industry Collaborator, Human Resources above), technician needs, and/or technicians' competencies/skills. These individuals could include individuals in the "Human Resource Development" units and/or those persons that Business/Industry assigns to work with the community colleges (e.g., members of advisory committees). Within individual companies, second and third level sources will be technician supervisors and technicians themselves.

Business/Industry Collaborator and/or Human Resources: For ATE sites, this is the individual who works with faculty and staff at the local community college to prepare technicians to serve the business/industry's needs. The team leader should be primary on interviewing this individual, whenever possible. For non-ATE sites, this is the individual identified by an ATE site as someone collaborating with a local community college without an ATE program. Again, the team leader should be primary on interviewing this individual, whenever possible.

Site Visit Reports and Data Analysis

The process of compiling, organizing, synthesizing, and reporting information from a large group of site visits is a major task. The outline below is intended as a means to facilitate our analysis and reporting efforts for the business/industry site visits. As indicated elsewhere in our site visit planning, we expect one person from each site-visit team to take charge and ensure the preparation, compilation, and return of site visit data and reports. This document does not deal with the managerial aspects of the data collection and reporting process. Rather, it outlines the way in which data are to be handled to ensure that findings from our study can be used to produce accurate, effective, and useful findings, conclusions, and recommendations.

Directions: Each site visit includes interviews at multiple companies and multiple types of persons within each company. ***Each site visit report will include the data collected, findings for individual companies, and syntheses across companies that characterize the individual site.*** Data from individual sites will then be combined to create an overall report. Based on the overall report, a determination will be made as to whether to extend the study to gather data from additional sites via a survey or interview process.

Each site visit report will contain: (a) interview data for each interviewee or interview group, (b) a business/industry report for each company visited, (c) a compilation of artifacts pertinent to and supporting data gathered, (d) and an overall site report that cuts across all companies visited at the site and provides a synthesis of findings and preliminary conclusions. [In conjunction with the site visit, information about the community college referenced in the site visit will be collected as well. This information will be gathered separately (e.g., obtained from the college catalog, the college Web site or via a brief telephone call to a college department chair or faculty member) and coupled to the site data when the site report is submitted.

Data analysis will begin with data entry of interviews and site-visit reports into Nudist.

I. Site Visit data
   A. Interviewer report for each interview (individual or group)
      1. Complete the demographic sheet regarding the person or group interviewed
      2. Organize respondent answers in the order presented in the interview form and clearly mark responses so that the answers are directly linked to a specific question. When a person responds to or addresses an issue called for in a different item (e.g., refers back to a previous question and provides more information for it) the information should be included with the appropriate

question but “tagged” so that it is clear when the information was gained during the interview.

3. For each item on the interview form carefully summarize the respondent’s answer.
    a) Use the language of the respondent (example statements, etc.) where possible.
    b) Earmark (identify) information that is synthesis in nature rather than direct responses of the person interviewed.
4. Identify emerging information (things not directly addressed by questions but which appear to be important), describe why they appear relevant.
    a) This should be low inference on the part of the interviewer.
    b) The relevance should have been provided by the interviewee or is clear from the context of other questions, etc.
5. Earmark interview information that appears most significant
6. Identify information that appears anomalous or appears to require a cross-check

B. Single business/industry report for the site
1. Summarize information by respondent type within a company (e.g., Human resources)
    a) Report the number of respondents for each summary
    b) Indicate whether data was obtained via individual interviews, focus groups, or some combination.
    c) Use the same general form as completed for the interview reports

C. Overall site reports
1. Provide a brief summary for each respondent type
    a) Use the same general form as that for an individual interview
    b) Make special notes of consistencies and anomalies across businesses for the specific respondent type
    c) Specify key findings, conclusions, and recommendations based on the respondent type.
2. Synthesize across the business/industry reports using the same general process as applied to the site report for each respondent type. Address at least the following questions:
    a) What are the characteristics of business and industry practices which make for an excellent collaboration with community colleges in improving technician education (using the ATE Program as a model)?
        (1) To what extent do local community colleges serve business/industry workforce needs?
        (2) In what ways can business/industry and community college systems better collaborate to improve technician preparation to serve its identified needs
        (3) To what extent do business/industry view the ATE Program as adding value to its technician workforce

    b) What is necessary for this process to be effective from the business perspective?
        (1) Strengths of the relationships and enablers for success
            (a) Assessment of impact of ATE (or value added) from these businesses/industries’ perspectives

(b) Relationship to what was seen/heard and the data provided in the survey (if the project said it had strong collaborations with business/industry, was there evidence of this?)

(2) Barriers to success

(3) Potential for sustainability

3. Provide site-visit specifics regarding
    a) dates of visit, who participated in the site visit, who was interviewed at each business/industry, how long each interview lasted, what if any deviations from site-visit plans occurred, and what if any problems occurred during the site visit.
    b) contextual information, picture of each site visited, types of companies visited, etc.
    c) list of artifacts gathered from each of the sites and how those artifacts were handled (e.g., how they are stored and available for use in preparing the overall report)

II. Concomitant with the site visit a limited amount of community college information is to be gathered for the site
    A. College size
        1. Faculty size
        2. Student size
    B. College age
    C. Program information
        1. Name of relevant technician program(s)
        2. Brief description (one paragraph) of the program
        3. Program age(s)
        4. Number of instructors in the program
            a) full time
            b) part time
        5. Number of program graduates for the previous three years
        6. Existence of a business/industry advisory group

III. Data analysis plan. As point 1, Site Visit Data, suggests some of the preliminary analyses begin with the synthesis of information to create company reports and the following overall site reports.
    A. Each site visit report is to be sent intact to the Co-PI/Project Manager for filing as a backup and for verification purposes in the event of concerns about data contamination or lost data.
    B. All site visit data and reports are to be entered into a qualitative data analysis package Nudist® for preparation of the overall report across sites.
    C. General working strategy for preparation of the overall report.
        1. As a means to cross-validation key findings, two analysis teams will work independently. Each team will prepare an overall report about the value added by the ATE program and each will substantiate its findings, conclusions, and recommendations, based on all the data in the Nudist® data set.
        2. Once both teams have completed their draft reports, a working conference of the teams, along with at least two members of the advisory panel, and possibly two persons from the sites visited (if confidentiality concerns can be adequately addressed):

a) will review the separate reports and identify what key points to make in the project report
b) make a determination of whether to recommend to NSF that a survey of additional business/industry-community college sites be conducted.

3. The two team leaders (Gullickson and Lawrenz?) together synthesize findings from the conference to prepare the draft final form of the value-added study.

D. Preliminary ideas for organization of the value-added report
1. Key factors
a) ATE- or Non ATE-based business/industry (Independent variable)
b) Moderator variables
(1) Institution and program characteristics of the community college
(2) Discipline (e.g., environmental engineering)
(3) Respondent type
2. Initially summarize for overall findings by ATE non ATE
3. Summarize by respondent type

Look for institutional (community college) and discipline factors that are related to both the experimental and respondent type variables.

Overall Study Report Outline

The following outline for the study report is provided to illustrate how the individual site reports will be synthesized into this report.

I. Introduction
II. Study Purpose (Research Questions and Hypotheses)
III. Methodology (may be an appendix)
   a. Study Design
   b. Target Population and Sample
   c. Procedural Steps
IV. Findings
   a. Identified Business/Industry Needs for Community-College Prepared Technicians
      i. Number
      ii. Knowledge and skills
   b. The Extent to Which Local Community Colleges Serve Business/Industry Workforce Needs
   c. Ways in Which Business/Industry and Community College Systems Can Better Collaborate to Improve Technician Preparation to Serve Its Identified Needs
   d. Extent to Which Business/Industry View the ATE Program as Adding Value to Its Technician Workforce
V. Recommendations
   a. Business/Industry
   b. Community Colleges
   c. NSF

Abbreviations/Terms You May Find on the Site Visit Data Collection Forms

ATE – Advanced Technological Education
GPRA – Government Performance and Results Act
NCTM – National Council of Teachers of Mathematics
NSF – National Science Foundation
PI – Principal Investigator
SCANS – Secretary's Commission on Achieving Necessary Skills
STEM – Science, Technology, Engineering, and Mathematics

ATE Outcomes

Collaboration – of *projects* with businesses, industries, educational institutions, and other organizations to achieve *project* objectives.

Standards Development – efforts focusing on aligning *project* work and products to workforce standards or guidelines, mathematics and science education standards, or other applicable standards.

Course, Curriculum and/or Materials Development – conducted by projects and centers. "Materials" include one or more courses, modules, process models, and/or other instructional or assessment units. "Development" includes the preparation, adaptation for implementation and/or testing of materials.

Professional Development – efforts focusing on instruction and/or support provided to teaching faculty and staff to update their knowledge and skills, and to train them to teach new or improved curricula effectively.

Program Improvement – efforts at the (a) secondary school, (b) associate degree, and (c) baccalaureate degree levels. "Program improvement" refers to multiple, related courses, and/or field experiences for students at the designated education level that lead to a defined outcome such as a degree, certification, or occupational completion point.

Recruitment – efforts focusing on bringing new students, including under-represented students into the courses or programs developed or improved by the ATE *project*

Student Services – efforts focusing on enabling the students in the ATE-developed courses or programs to be successful

Sustainability/Transportability/Dissemination – processes that support the institutionalization of *project* work and products and the sharing of *project* work with other institutions

Protocols,
including Questionnaires

Field Notes/Observations/Document Collection

Date: ________ Name of Team Member: ________________________

Business/Industry Site: ______________________________

<u>Directions for the Team Member</u>**: All members of the study team should fill out a separate field notes form to share during the debriefing. Your notes should include perceptions of all things viewed during the visit and documents you've collected and also provided to you related to the collaboration with the local community college for technician education.**

1a. What is the whole site like in terms of where it is situated? As you drive to the site, please observe the community surrounding the business/industry. Take pictures when appropriate. Please describe the surrounding community (e.g., approximate size/distances, types of businesses/industry present, socioeconomic status, urban/suburban/rural, ethnicities observed, type of buildings, level of repair, transportation available, etc.).

1b. What is the business/industry site like? Please describe size, type of buildings, level of repair, laboratory facilities, industrial-like facilities.

2. What is the atmosphere/culture of the business/industry? What is the feeling or tone expressed? What are interpersonal relations like? Is there evidence of respect, helpfulness, and professionalism among staff and between staff and others?

3. What other salient characteristics strike you as you make observations of various activities?

Document Collection

4. Prior to your visit, the team leader will be provided with a course catalog for the community college. Please ask those interviewed, especially the business/industry collaborator, for documents that illustrate the relationship with the community college.

Picture Taking

5. For each picture taken, please have participants sign the photo release form. Pictures of those interviewed, the facilities, and various activities may be helpful to illustrating the report.

Critical Questions for Site Visitors

Whenever possible, please try to ask all the questions on the appropriate interview form (e.g., Business/industry collaborator, human resources, technician supervisor, technician). However, when there are time constraints, please be sure to ask the following questions that will assist you in writing the site visit report:

1. What are your needs for community college prepared technicians in terms of number of technicians and technician knowledge and skills? (For the technician, what demand do you see and what knowledge and skills have been most useful to you in your present position?)
2. To what extent and how has the local community college served your technician workforce needs as you just identified them, including your level of satisfaction with the current technician-based programs at the community college? (For the technician, inquire regarding his/her satisfaction with the education received through the community college in relation to his/her present position).
3. What are some ways in which business/industry and community college systems can better collaborate to improve preparation of technicians to serve their identified workforce needs? (for the technician, how can business/industry and the community college systems partner better to assist you in obtaining the necessary knowledge and skills for your position?)
4. What is the strength of the relationship between your particular business/industry and the community college? What are factors that enhance this relationship? What are factors that impede this relationship?
5. In five years, how will the relationship between your particular business/industry and the community college look? Work?
6. What else should I know or learn about your interactions with your local community college regarding their preparation of technicians?

For ATE sites, ***if they bring up ATE***:

1. How did you first hear about the ATE program? What has been your involvement?
2. What are your impressions of this program from your business/industry perspective?
3. How is it similar to a traditional technician preparation program at your community college?
4. How is it different than a traditional technician preparation program at your community college?
5. Are there differences in the skills and knowledge of those technicians from the ATE program vs. those from other community-college based programs?
6. Is there a similar business/industry to yours working with a community college that doesn't have an ATE grant funded program? If so, could you provide the contact information (name, phone number, email)? Will you give me your permission to mention your name when I make this contact?

Business/Industry Collaborator

Date: ________ Name of Interviewer: ________________________

Interview Location: _________________ Name of Interviewee: ________________________

Affiliation of Interviewee: __________________________

Contact Information (name, phone, email): ____

Directions for the Interviewer: This interview should last about 45-60 minutes and be limited to 10 or so questions. Probes are in italics after some of the numbered questions. If the respondent does not offer the information that would be gained from the probes after you ask the numbered question, please ask the probing questions. When appropriate, questions may be pulled from the Human Resources Questionnaire.

1. How have you been involved with the local community college (provide name of the community college)? (*nature of collaboration, length of time, how partner with community college as related to technician preparation—support provided, products of collaboration)*
2. What are your business/industry needs for community college prepared technicians in terms of number of technicians and technician knowledge and skills? *(What are the three most important characteristics [skills, knowledge] you look for in hiring and keeping technicians? How many will you need in the next year, next 5 years?)*
3. To what extent and how has the local community college served your technician workforce needs as you just identified them, including your level of satisfaction with the current technician-based programs at the community college? (*Using a scale of 1-10 [poor to excellent] for satisfaction and why, inquire into the specific programs from the local community college)*
4. What are some ways in which business/industry and community college systems can better collaborate to improve preparation of technicians to serve b/i identified workforce needs?
5. What is the strength of the relationship between your particular business/industry and the community college? (*Using a scale of 1-10 [poor to excellent])* What are factors that enhance this relationship? What are factors that impede this relationship?
6. In five years, how will the relationship between your particular business/industry and the community college look? Work?
7. What else should I know or learn about your interactions with your local community college regarding their preparation of technicians?

For ATE sites, ***if they bring up ATE (likely to occur in this interview):***

7. How did you first hear about the ATE program? What has been your involvement?
8. What are your impressions of this program from your business/industry perspective?
9. How is it similar to a traditional technician preparation program at your community college?
10. How is it different than a traditional technician preparation program at your community college?
11. Are there differences in the skills and knowledge of those technicians from the ATE program vs. those from other community-college based programs?
12. Is there a similar business/industry to yours working with a community college that doesn't have an ATE grant funded program? If so, could you provide the contact information (name, phone number, email)? Will you give me your permission to mention your name when I make this contact?

Human Resources

Date: ________ Name of Interviewer: _________________________

Interview Location: __________________ Name of Interviewee: _________________________

Affiliation of Interviewee: ___________________________

Contact Information (name, phone, email): ____

<u>Directions for the Interviewer</u>: This interview should last about 45-60 minutes and be limited to 10 or so questions. Probes are in italics after some of the numbered questions. If the respondent does not offer the information that would be gained from the probes after you ask the numbered question, please ask the probing questions. When appropriate, questions may be pulled from the Business/Industry Collaborator Questionnaire.

1. How many technicians do you employ?
2. Describe the characteristics [skills and knowledge] required of your typical technician (*What technician characteristics (skills and knowledge) are most important in the context of your department? Are your technicians sufficiently knowledgeable and skilled to do their work?)*
3. Describe how your typical technician is prepared for his/her position (*Sources for this preparation, How skilled are your new technicians upon entry [e.g., do they meet your entry requirements]? In what skills are they best prepared? In what areas could/should their entry skills be improved? How do you encourage and support technicians in updating their knowledge and skills?*)
4. What are your business/industry needs for community college prepared technicians in terms of number of technicians and technician knowledge and skills? *(What are the three most important characteristics [skills, knowledge] you look for in hiring and keeping technicians? How many will you need in the next year, next 5 years?)*

1. To what extent and how has the local community college served your technician workforce needs as you just identified them, including your level of satisfaction with the current technician-based programs at the community college? (*Using a scale of 1-10 [poor to excellent] for satisfaction and why, specific programs from the local community college)*
2. What are some ways in which business/industry and community college systems can better collaborate to improve preparation of technicians to serve b/i identified workforce needs?
3. What is the strength of the relationship between your particular business/industry and the community college? (*Using a scale of 1-10 [poor to excellent])* What are factors that enhance this relationship? What are factors that impede this relationship?
4. In five years, how will the relationship between your particular business/industry and the community college look? Work?
5. What else should I know or learn about your interactions with your local community college regarding their preparation of technicians?

For ATE sites, ***if they bring up ATE (likely to occur in this interview)****:*

1. How did you first hear about the ATE program? What has been your involvement?
2. What are your impressions of this program from your business/industry perspective?
3. How is it similar to a traditional technician preparation program at your community college?
4. How is it different than a traditional technician preparation program at your community college?
5. Are there differences in the skills and knowledge of those technicians from the ATE program vs. those from other community-college based programs?
6. Is there a similar business/industry to yours working with a community college that doesn't have an ATE grant funded program? If so, could you provide the contact information (name, phone number, email)? Will you give me your permission to mention your name when I make this contact?

Technician Supervisor

Date: ________ Name of Interviewer: ________________________

Interview Location: _________________ Name of Interviewee: ________________________

Affiliation of Interviewee: __________________________

Contact Information (name, phone, email): ____

<u>Directions for the Interviewer</u>: This interview should last about 45-60 minutes and be limited to 10 or so questions. Probes are in italics after some of the numbered questions. If the respondent does not offer the information that would be gained from the probes after you ask the numbered question, please ask the probing questions.

1. Describe your position as a supervisor (*How many technicians do you supervise? What technician fields are involved? Do you supervise any technicians that have participated in the local community college technician education program?*)

2. Describe the characteristics [skills and knowledge] required of your typical technician (*What technician characteristics (skills and knowledge) are most important in the context of your department? Are your technicians sufficiently knowledgeable and skilled to do their work?)*

3. Describe how your typical technician is prepared for his/her position (*Sources for this preparation, How skilled are your new technicians upon entry [e.g., do they meet your entry requirements]? In what skills are they best prepared? In what areas could/should their entry skills be improved? How do you encourage and support technicians in updating their knowledge and skills?*)

4. What value does the local community college technician based education program have for your department's technicians' needs*? (How does the community college program compare with other educational opportunities technicians engage in? Do you personally collaborate with the local community college relative to its technician education program? If so, in what ways and how extensively do you collaborate? Specifically ask if the supervisor facilitates internships or other hands-on programs with the community college).*

For ATE sites, ***if they bring up ATE****:*

1. How did you first hear about the ATE program? What has been your involvement?
2. What are your impressions of this program from your business/industry perspective?
3. How is it similar to a traditional technician preparation program at your community college?
4. How is it different than a traditional technician preparation program at your community college?
5. Are there differences in the skills and knowledge of those technicians from the ATE program vs. those from other community-college based programs?

Technician

Date: ________ Name of Interviewer: __________________________

Interview Location: __________________ Name of Interviewee: __________________________

Affiliation of Interviewee: ____________________________

Contact Information (name, phone, email): ____

<u>Directions for the Interviewer</u>: This interview should last about 45-60 minutes and be limited to 10 or so questions. Probes are in italics after some of the numbered questions. If the respondent does not offer the information that would be gained from the probes after you ask the numbered question, please ask the probing questions.

1. What type(s) of technician education program have you participated in? (*employer based?, community college? Other? Length, college credits, certification or degree, description and skills obtained, quality, how recent)*
2. On a scale of 1 (poor) to 10 (excellent), rate the primary technician education program in which you participated. Why did you give this rating?
3. On a scale of 1-10, rate the skills and knowledge you learned in the technician education program on their usefulness related to your current job.
4. What skills did you learn in this technician education program? What additional skills should have been included in relation to your present position?
5. Would you recommend this technician education program to a friend or relative? Why or why not?
6. What demand do you see for your type of position and what knowledge and skills have been most useful to you in your present position?

For ATE sites, ***if they bring up ATE****:*
1. How did you first hear about the ATE program?
2. What are your impressions of this program related to other technician education programs that you or others you know may have participated?
3. How is it similar to a traditional technician preparation program at your community college?
4. How is it different than a traditional technician preparation program at your community college?
5. Are there differences in the skills and knowledge of those technicians from the ATE program vs. those from other community-college based programs?