



ADVANCED TECHNOLOGICAL EDUCATION PROGRAM EVALUATION WORKFORCE NEEDS ASSESSMENT

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Abstract

This brief focuses on how ATE projects and centers are conducting workforce needs assessments and how this information is being used in relation to project implementation. We discuss needs assessment as an evaluative activity and suggest that approaching it as such has the potential to concentrate the expertise of evaluators, increasing their capacity to make more meaningful summative evaluation statements about the impacts of ATE projects and centers. Survey findings reveal that (1) a majority of grantees do gather workforce needs assessment information in one or more ways, although there is a substantial dependency on “weak” forms of needs assessment; (2) grantees who do not gather workforce needs assessment data are in the minority; (3) centers are much more likely than projects to conduct workforce needs assessment once funding is awarded; (4) a variety of factors, including type of host institution, market focus, scope of industries served, and major disciplinary focus appear to be associated with whether or not projects and centers conduct workforce needs assessment; (5) the purposes for which workforce needs assessment information is considered most useful by grantees include developmental and formative evaluation activities; and (6) many PIs perceive that workforce needs assessment is not essential to their efforts. Overall, these findings suggest that the ATE program explore the potential for establishing guidelines regarding the conduct of workforce needs assessments.

The 2006 Briefing Papers are prepared from survey census data collected in February and March 2006 from principal investigators (PIs) of ATE projects and centers.¹ Each surveyed project/center was currently funded by the ATE program and had been funded for at least one year prior to the survey. The response rate for this survey was 92 percent. All PIs were expected to complete the organizational management section, which described project and center workforce needs assessment activities and served as the basis for this report.

1. WORKFORCE NEEDS ASSESSMENT IN THE CONTEXT OF THE ATE PROGRAM

This paper focuses on workforce needs assessments conducted by ATE projects and centers. Divided into five sections, this brief highlights how projects and centers are conducting workforce needs assessments and how this information is being used in relation to project implementation. Section 1 provides an overview of workforce needs assessment in the context of the ATE program. Section 2 examines the timing and extent to which *formal* workforce needs assessments were conducted by grantees and distinctions between projects

and centers with respect to these activities. Section 3 describes methodologies used to conduct the needs assessments, further examining differences between projects and centers. Section 4 discusses the manner in which PIs use information garnered through their workforce needs assessments as well as perceptions of the utility of this information. Section 5 briefly summarizes the survey findings. Finally, Section 6 addresses workforce needs assessment as an evaluative activity, exploring ways in which assessment activities might be enhanced, criteria that might be established with respect to methodologies and approaches, and ways in which current evaluation activities might incorporate, support, and utilize workforce needs assessment to assist in determining project impact.

Generally speaking, needs assessments are conducted for a variety of purposes, such as determining goals and priorities, program planning, justification for funding or

¹ This briefing paper is based on survey data from the 2006 survey of ATE projects and centers. For a description of the survey’s sampling method, response rates, and overall findings, refer to the *Advanced Technological Education Program Fact Sheet* (Coryn, Ritchie, & Gullickson, 2006), and *2005 ATE Technical Report: Processes, Procedures, and Results* (Coryn & Hanssen, 2005).

continued funding, obtaining other types of support, resource allocation, federal mandates (Reviere, Berkowitz, Carter, & Ferguson, 1996; Soriano 1995; Witkin 1994), and occasionally to justify the existence of a program or policy (Davidson 2005; Scriven 1991).

In the context of the ATE program, workforce needs assessment is important because the program's central goals are to produce more science and engineering technicians to *meet workforce demands* and improve the technical skills and the general science, technology, engineering, and mathematics (STEM) preparation of these technicians and the educators who prepare them. The following statements appear in Program Solicitation NSF 05-530 (National Science Foundation, 2005) and directly reflect the importance of understanding workforce demands and addressing and meeting the needs of potential employers:

- Projects “should respond to employers’ need for well-prepared technicians” (p. 4)
- “All projects must be guided by a coherent vision of technological education—a vision that recognizes students as life-long learners together with the needs of the modern workplace” (p. 4)
- Program improvement projects “should provide business and industry and public sector agencies with a larger pool of skilled technicians” (p. 5)
- ATE planning grants are “to meet the emerging educational needs of employers” (p.7)
- National Centers “should develop high-quality programs and curricula that reflect the modern technological workplace” (p. 9)
- “Regional Centers are expected to focus mainly on reforming academic programs to produce a greater number of highly qualified workers who meet regional workforce demands and who also meet national industry and academic skill standards” (p. 9)

Explicit in these statements is the intention of the ATE program to meet the need for a better-prepared, more highly skilled, and larger technological workforce. This intention carries with it the expectation that activities proposed by projects and centers should respond to identified workforce needs, and presumes that grantees either have a clear understanding of workforce needs they intend to address or a plan to assess those needs. Moreover, as noted in the program solicitation, ATE PIs must report in the *Project Information Resource Systems* (PIRS) their “project’s impact on workforce needs . . . and other measures of the project’s effect on the quality and quantity of technicians being educated for the high-

tech workplace” (National Science Foundation, 2005, p. 16). This reporting requirement makes the additional assumption that there is some sort of baseline data or information (or that there should be some such data) from which to measure change—i.e., impacts or effects.

In the ATE Program Solicitation’s “Additional Review Criteria,” one of the key questions associated with the intended Broader Impacts specific to the ATE Program Solicitation is, “Does the project work with employers to address their current and future needs for technicians?” (p. 15). Clearly, this sets the expectation that funded projects and centers will conduct workforce needs assessment. What is not clear in the solicitation is *how* and *to what extent* projects and centers should engage in workforce needs assessment. For example, at a minimum, one might expect that a workforce needs assessment in a given industry or field would include but not be limited to addressing numbers, types, and locations of available positions; compensation ranges for various positions; and required competencies, skills, and knowledge.

With that said, the ATE Program Solicitation provides no guidelines for conducting workforce needs assessment or criteria for what represents adequate, valid, and reliable information. This leaves the decision to proposal reviewers as to which proposals have what they consider to be adequate, valid, and reliable information upon which to base their proposed activities and, ultimately, to evaluate the impacts of their efforts. Importantly, because there are no proposal guidelines in this arena, the next question that arises is, *What workforce needs assessment criteria are reviewers using in their evaluation of proposals?* Independently, they may be using very different standards.

In responding to the survey item that asked PIs to describe the current “growth mode” of the industry or industries on which their project or center focused, 29 percent reported “high growth,” one-half reported “moderate growth,” 13 percent indicated “stable,” while the remainder reported “moderate decline” and “significant decline” (4% and 1%, respectively). One might reasonably ask what evidence, if any, they are using to make their judgment and respond to this question.

Certainly, this is not to say that ATE projects and centers have no understanding of their industry constituencies. Rather, the points raised above beg these questions: *How and to what extent are ATE projects and centers assessing workforce needs? What is the quality of the*

data being used by grantees? To what extent is workforce assessment data/information considered useful among PIs? For what purposes are projects and centers using workforce assessment data/information?

2. WORKFORCE NEEDS ASSESSMENT ACTIVITIES OF ATE PROJECTS AND CENTERS

Of the 163 ATE grantees reporting their organizational practices, 161 (99%) responded to questions about their workforce needs assessment activities. Respondents were asked to indicate how recently they had conducted a formal workforce needs assessment to guide their work; response options included “never,” “prior to receiving this ATE grant,” and “since receiving this ATE grant.” This section of the paper examines workforce needs assessment activities with respect to (i) grant size; (ii) distinctions by project and center; (iii) type of host institution; (iv) major area of emphasis for projects and centers (disciplinary focus); (v) the primary geographical market of projects and centers; and (vi) the scope and perceived importance of industries served.

As shown in Figure 1, grantees receiving the smallest amount of funding (based on annualized means), were those who reported that they had never conducted a workforce needs assessment. At first glance, the combined figures across projects and centers regarding workforce needs assessment activities might be considered quite positive—with almost three-quarters of all grantees reporting that they have conducted needs assessments at some point. However, this leaves fully one-quarter of grantees who indicated they have not assessed the needs of their workforce constituencies.

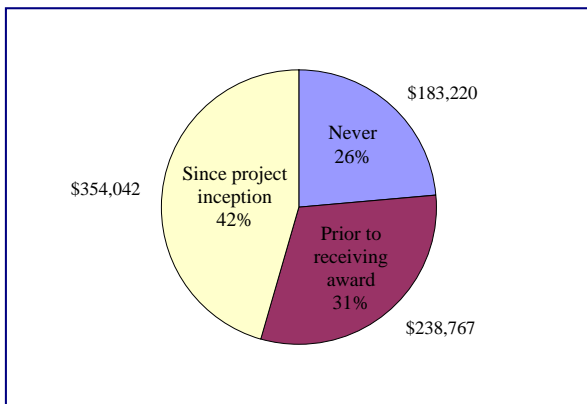


Figure 1.
Conduct of Workforce Needs Assessment by Annualized Award Means of Projects and Centers

Nearly all centers do some type of workforce needs assessment but one-third (33%) of projects have never

done so. As Figure 2 shows, the major differences between center and project needs assessment efforts occur after funding occurs; a similar proportion of projects and centers reported conducting needs assessments prior to receiving their awards.

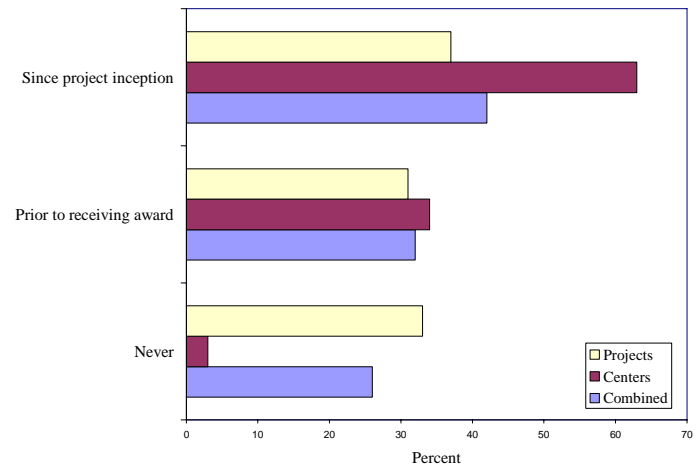


Figure 2.
Most Recent Workforce Needs Assessment Conducted by Projects and Centers

There are also differences in levels of workforce needs assessments by the type of grantees’ host institution. A large majority of the survey sample (88%) represents 2-year institutions (76%, $N = 124$) and 4-year institutions (12%, $N = 20$).² As shown in Figure 3, both types of institutions were equally likely to have conducted a workforce needs assessment since receiving their ATE grants; but 2-year colleges were much more likely to have conducted such an assessment prior to funding.

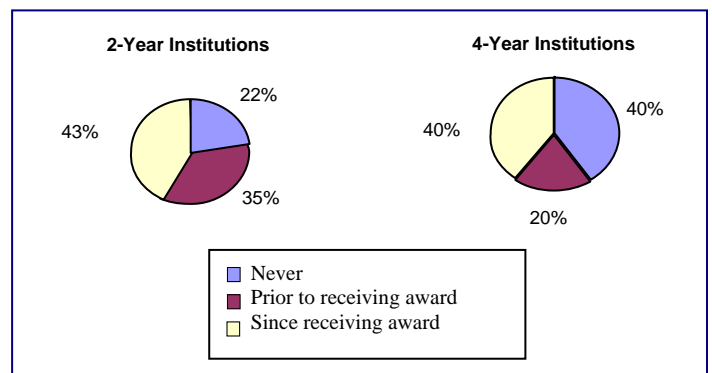


Figure 3.
Most Recent Workforce Needs Assessment Conducted by 2-Year and 4-Year Institutions

² Additional categories are: “Association/Society” ($N = 7$), “Secondary School” ($N = 1$), and “Other” ($N = 11$).

Of the 17 specified disciplinary categories, the greatest proportion of grantees (18%) reported information technology and communications as their major area of emphasis, followed by general engineering technology (10%), multidisciplinary or interdisciplinary (9%), manufacturing and industrial technology (8%), and biotechnology (7%). Generally speaking, it is within these areas that we also find the greatest proportion of grantees having conducted workforce needs assessments either prior to or since receiving their awards (see Table 1).

Whether a needs assessment was done and when it was done appear to vary by geographical market emphasis. PIs were asked what they considered to be the “primary market” for participants in or products of their ATE project or center. Most respondents reported a national market focus (39%), 21 percent a regional focus, 17 percent a state focus, and 19 percent indicated their primary market focus was local.

Table 1.
Most Recent Workforce Needs Assessment
Conducted by Major Disciplinary Focus

Major Disciplinary Focus	Never	Prior to Receiving Award	Since Receiving Award
Information technology & communications (N = 28)	7%	36%	57%
General engineering technology (N = 17)	24%	35%	41%
Multidisciplinary or interdisciplinary (N = 14)	64%	21%	14%
Manufacturing & industrial technology (N = 13)	0%	46%	54%
Biotechnology (N = 12)	25%	42%	33%

Note. Percents are based on survey respondents by category; numbers may not total 100% due to rounding.

As shown in Figure 4, grantees with a regional focus were most likely to have conducted a needs assessment since receiving ATE funding, followed by projects and centers with a national, state, or local focus. Grantees with a state focus were most likely to report having never conducted a workforce needs assessment, followed by those that are locally, nationally, and regionally focused. Almost one-quarter of nationally focused projects or centers—the market category identified as primary by the largest proportion of PIs—responded that they have never conducted a workforce needs assessment.

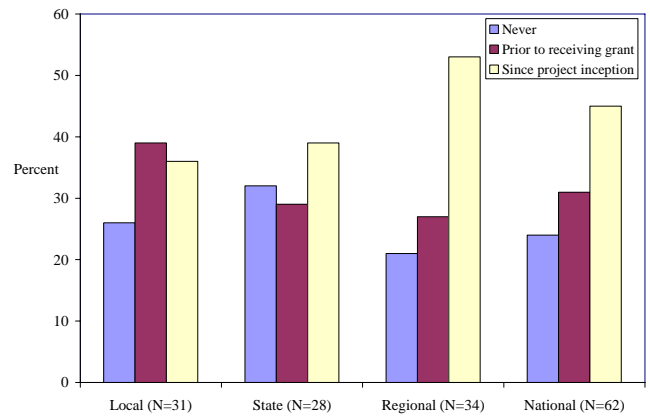


Figure 4.
Primary Market Focus
by Most Recent Workforce Needs Assessment

There are only minor differences in the scope of industry served with respect to whether or not grantees have engaged in workforce needs assessment (see Figure 5). Overall, more than half (53%) of grantees serve one or more closely related industries, followed by those serving different, unrelated industries (34%), with just 9 percent focusing their efforts on an individual industry. Whatever the scope of their industry focus, a majority of PIs reported having conducted workforce needs since project inception. Given the possible diversity of workforce demands among different, unrelated industries, one might expect minimal needs assessment to be conducted by grantees serving this constituency; however, this is not the case.

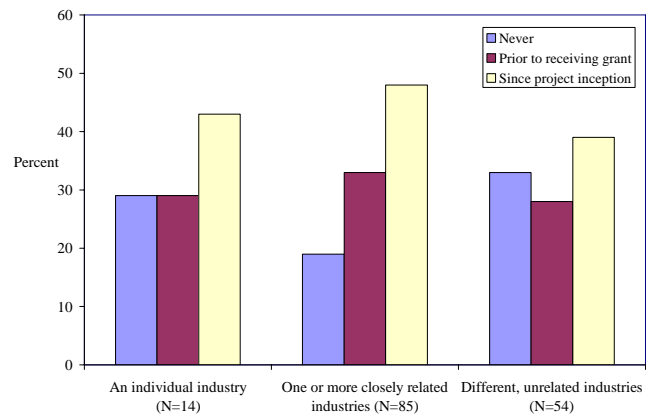


Figure 5.
Scope of Industries Served
by Most Recent Workforce Needs Assessment

Finally, the perceived importance of the industry on which grantees are focused appears to be associated with whether and when they conducted a workforce needs assessment. PIs were asked to rate the relative

importance of the industry or industries on which their efforts focused to the region on which they are focused.³ As depicted in Figure 6, PIs who indicated that the industry or industries on which their efforts were focused were “very important” to their region were much more likely than others to have conducted a workforce needs assessment either prior to or since receiving their grants. One-half of those rating the industry as “very important” reported having conducted a workforce needs assessment since receiving their ATE award; an additional one-third had done so prior to receiving their grant. Although our data do not enable us to address the “direction” of the relationship, it is interesting to consider whether needs assessments were conducted since receiving the grants *because* the perceived importance of the focus industry was high or grantees determined that their focus industry was “very important” because they had conducted a workforce needs assessment that provided evidence supporting that judgment.

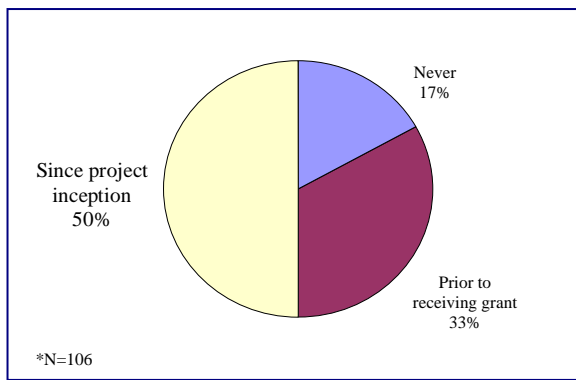


Figure 6.

Most Recent Workforce Needs Assessment by Grantees Rating the Importance of their Industry Focus as “Very Important” to their Region*

3. WORKFORCE NEEDS ASSESSMENT METHODOLOGIES EMPLOYED BY ATE PROJECTS AND CENTERS

Among seven specified methods of workforce needs assessment used by PIs since receiving ATE funding, the top three most frequently employed were obtaining advisory panel feedback, analyzing of existing data, and focus groups (see Figure 7). Here, the question arises as to the *quality* of the data being utilized. For example, workforce needs assessment data or information gathered through advisory panel feedback, focus groups,

³ Ratings of 1 = not important, 2 = marginally important, 3 = somewhat important, 4 = important, and 5 = very important.

formal interviews and, in particular, informal conversations (anecdotal information) may be somewhat useful but is insufficient to reliably and accurately determine demands of the technological workforce.

With these limitations in mind, substantial distinctions in utilization of assessment methodologies emerge when comparing projects with centers. Although grantees reported using each type of method to a certain extent, overall, centers were more likely than projects to have incorporated a broader variety of assessment methodologies. Since the inception of their grants, centers tended, on average, to use 2.71 ($SD = 2.71$) of the specified methods and projects used 1.28 ($SD = 1.97$).

Centers were much more likely than projects to analyze existing data, conduct formal focus groups, obtain feedback from an advisory panel, utilize anecdotal information, and conduct their own surveys. With the exception of utilizing advisory panel feedback, the proportion of centers employing these approaches was more than double that of projects. Notably, projects relied most heavily on feedback from their advisory panels, analysis of existing data, and information gathered via focus groups.

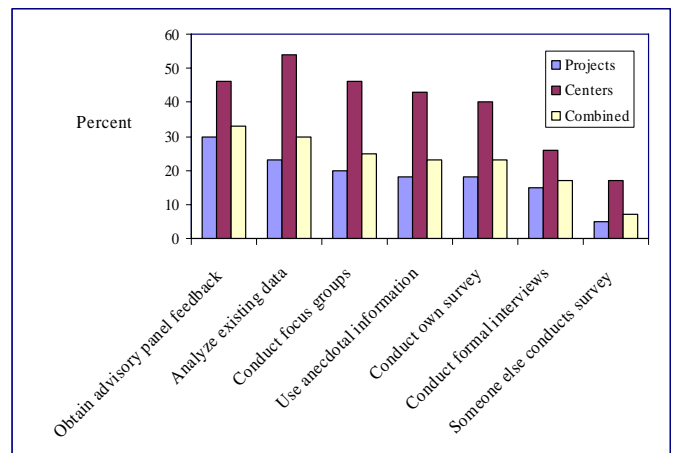


Figure 7.

Workforce Needs Assessment Methodologies Employed by ATE Grantees Since Project Inception

Because the question specified that PIs were to respond to subsequent items if they had conducted a *formal* workforce needs assessment, the reporting of considerable use of anecdotal information gathered through conversations, as well as advisory panel feedback, warrants additional consideration. If formal workforce needs assessment is defined as that which is systematically acquired and documented, anecdotal information and advisory panel feedback may or may

not constitute formal workforce needs assessment. Because advisory panel feedback appears to be such a major means of gathering workforce needs information, a related issue should not be overlooked: our data reveal that overall, more than half (55%) of PIs (29% of centers and 63% of projects) reported they had *not* received a written report from their advisory panel in the past 12 months. The heavy use of anecdotal and advisory panel feedback information raises concerns about the validity and reliability of the data although, in all cases where PIs reported using anecdotal information, they also used at least 1 other assessment method and in only 2 cases did grantees rely solely on anecdotal information and advisory panel feedback. Despite this caveat, our findings indicate a strong reliance on “weak” assessment approaches that yield unreliable results.

4. PRINCIPAL INVESTIGATORS’ PERCEPTIONS OF THE UTILITY OF WORKFORCE NEEDS ASSESSMENT INFORMATION

Our analysis of the extent to which PIs conducted workforce needs assessment activities also considers their perceptions of the usefulness of the information in the context of their projects or centers. Grantees were asked the extent to which workforce needs assessment was useful (from “not used” to “essential to our work”) for 12 specified purposes (see Table 2). Because project and center resources are limited, we focus here on purposes for which workforce needs assessment are considered “essential to our work” by PIs.

One could surmise that if PIs could conduct only a limited number of workforce needs assessment activities due to resource constraints (e.g., funds and time), they would opt to use the methods they deem essential (i.e., most useful) as well as those that are most cost effective (e.g., analyzing existing data rather than collecting their own). The top 5 purposes cited as “essential to our work” by PIs depict needs assessment activities that may be considered developmental or formative evaluation—evaluation undertaken to inform and improve project development and implementation (Patton 1997; Scriven 1991). This conceptualization of workforce needs assessment as an evaluative activity will be discussed in Section 6.

There are substantial differences in the ways that project and center PIs view the extent to which workforce needs assessment is useful for various purposes (see Figure 8). A much greater proportion of centers than projects considered workforce needs assessment essential for focusing program and/or course content, for focusing professional development activities, for general project planning/development purposes, and for focusing materials development. Again, these are purposes that may be considered developmental or formative evaluation activities. The notion of ATE grantees relying on business and industry for formative evaluation feedback is supported by responses to another survey item: 70 percent of centers and 35 percent of projects report that they “always” gather input from business and industry to assess the quality of materials they have developed (Gullickson, Coryn, & Ritchie, 2006).

Table 2.
Purposes for Which Workforce Needs Assessment is Considered “Essential” by ATE Grantees

Rank	Purpose	N	P
1	To focus program and/or course content	83	51%
2	To set goals and objectives	80	49%
3	To focus materials development	63	39%
4	For general project planning/development purposes	59	36%
5	To focus professional development activities	55	34%
6	To recruit students	46	28%
7	For general marketing purposes	40	25%
8	To make a case for articulation agreements	27	17%
9	To gain administrative support	26	16%
10	To recruit faculty and/or staff	22	13%
11	To gain faculty support	21	13%
12	To secure project funding from other sources	15	9%

Note. Percents are based on total number of survey respondents (N = 163).

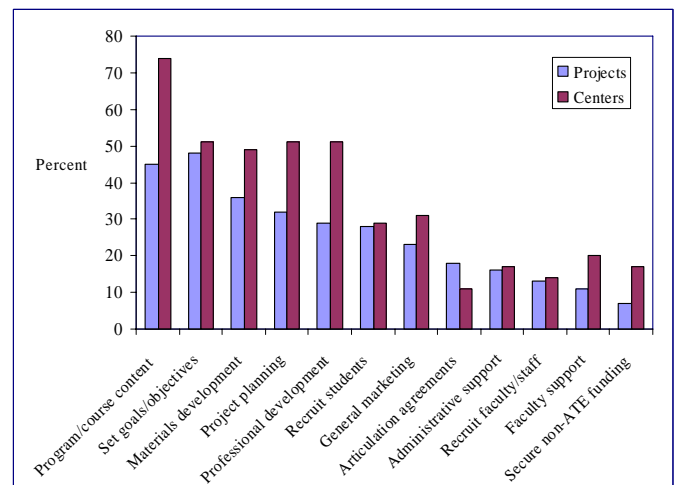


Figure 8.
Proportion of Projects/Centers Rating Workforce Needs Assessment as “Essential” for Various Purposes

5. SUMMING UP

As discussed in Sections 2-4, survey findings reveal that (1) a majority of grantees do gather workforce needs assessment information in one or more ways, although there is a substantial dependency on “weak” forms of needs assessment; (2) grantees who do not gather workforce needs assessment data are in the minority (26%); (3) centers are much more likely than projects to conduct workforce needs assessment once funding is awarded; (4) a variety of factors appear to be associated with whether or not projects and centers conduct workforce needs assessment (e.g., type of host institution, market focus, scope of industries served, major disciplinary focus); (5) the purposes for which workforce needs assessment information is considered most useful by grantees include developmental and formative evaluation activities; and (6) many PIs perceive that workforce needs assessment is not essential to their efforts.

If we consider the survey data that focus on the extent to which PIs consider workforce needs assessment as “essential” for different purposes, then the perceived value of the activity is generally low—that is, not deemed more than “useful” by a substantial proportion of PIs. *Why might this be?* Although our data do not address this question, one likely possibility is that grantees believe they know the answers (whether or not they collected the data). If this is the case, then it follows that grantees would not use limited financial and personnel resources to “answer the question again.” People tend to trust anecdotal information, especially when it comes from a source they trust (e.g., an advisory panel). Or, perhaps PIs have a limited understanding of the potential utility of workforce needs assessment data to enhance programmatic activities. One might also infer that grantees and their evaluators have not fully considered the value of such data for evaluation purposes—the focus of our discussion in the concluding section.

6. WORKFORCE NEEDS ASSESSMENT AS AN EVALUATIVE ACTIVITY

ATE clearly calls for workforce needs assessment and, as such, all (100%) of grantees should gather and use the information. As discussed in Section 1, the purpose of the ATE program—to produce more science and engineering technicians—is delineated in the program solicitation. Explicit in the solicitation is that projects and centers address and meet technological workforce demands and, ultimately, report the impacts of their

efforts on the workforce. This necessarily means that they must gather and use workforce needs assessment information.

When approaching needs assessment as an evaluative activity, several issues emerge with regard to the extent to which and how ATE grantees engage in and utilize workforce needs assessment. As previously mentioned, projects and centers alike tend to find needs assessment information valuable for developmental and formative evaluation purposes—focusing their activities, setting goals and objectives, and so forth.

It would seem, however, that the idea of workforce needs assessment being tied to evaluation in the context of the ATE program and among grantees is quite limited. According to our data, there appears to be no relationship between ATE grantees having any sort of evaluator (internal, external, or both) and the extent of their needs assessment activities. Additionally, the types of evidence identified by PIs as being used to assess the quality of materials development, program improvement, and professional development activities (see Briefing Paper #6 in this series [Gullickson, Coryn, & Ritchie, 2006]) do not suggest that there is a clear understanding of the relationship between gathering valid and reliable baseline workforce needs assessment data and the potential for using this information for evaluative purposes. Making this connection would strengthen and enhance the ability of grantees and the ATE program as a whole to assess the impacts of their efforts.

Reinforcing the idea that there is a limited understanding of the tie between needs assessment and evaluation are the evaluation resources recommended for use in the ATE Program Solicitation. *The 2002 User-Friendly Handbook for Project Evaluation* (Frechtling, Frierson, Hood, & Hughes, 2002) and *The User-Friendly Handbook for Mixed Method Evaluations* (Frechtling & Sharp, 1997) each refers once to needs assessment (not specifically workforce needs assessment) as an aspect of evaluation. The 2002 handbook includes a diagram indicating that needs assessment is part of the evaluation cycle, with no further explanation. In the other document, the phrase “needs assessment” appears only in the title of one of the references cited. Additionally, a review of the Online Evaluation Resource Library for NSF’s Directorate for Education and Human Resources does not appear to include any reference to or guidelines for needs assessment.

In order to achieve the overall goals of the ATE program, grantees necessarily require an understanding of demands and competencies of the workforce for which they are preparing students, professional development activities, or materials. Several questions remain, however, as the ATE program moves forward:

- *Is there a general consensus among ATE program stakeholders—NSF, proposal reviewers, grantees, students and educators, business and industry, and those with vested political interests—as to what constitutes valid and reliable workforce needs assessment information?*
- *To what extent is workforce needs assessment information important to ATE? (E.g., What are the real ATE and industry costs for proceeding without sound assessments of workforce needs?) Is this level of importance (or, perhaps, lack thereof) communicated to PIs?*
- *How might more, better, or different workforce needs assessment information enhance the activities or efforts of projects and centers?*
- *How might more, better, or different workforce needs assessment information enhance the ability of grantees to determine their impacts on the technological workforce?*
- *Should workforce needs assessment be considered a key element of evaluation activities?*

The answers to these questions have the potential to inform and improve the overall impact of the ATE program. We strongly encourage ATE to explore the possibility of establishing guidelines regarding the conduct of workforce needs assessments; this will assist those submitting proposals, as well as reviewers, in determining what constitutes acceptable criteria and/or methods for workforce needs assessment information. Moreover, conceptualizing and approaching workforce needs assessment as an evaluative activity would concentrate the expertise of evaluators and increase their capacity to make more meaningful summative evaluation statements about the impacts of ATE projects and centers.

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