Recruitment and Retention

in the ATE Program

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Executive Summary

One goal of the ATE program is to increase the number of skilled technicians in this country. Successful achievement of this goal will require effective recruitment and retention (R & R) of students. In this paper, we examine these R & R efforts.

Four data sources were examined for information on this issue: NSF-based publications, literature on the topics of recruitment and retention, responses from two surveys of project directors, and reports of site visits.

We describe findings from current literature that helped our understanding of the general background issues surrounding recruitment and retention as well as the various strategies employed to enhance both efforts. We present a model for R & R practice that contains three elements: Information, Preparation, and Support. Those elements and methods to serve them are elaborated through a series of tables. We supplemented the tabular information with five case examples. These cases show recruitment and retention from different vantage points.

Several conclusions were reached as a result of our analysis:

NSF's guidelines for funded *projects* (i.e., ATE projects and centers) encourage the development of programs that recruit and retain groups that have been traditionally underrepresented in technology positions. Stronger and more specific language regarding accountability of R & R has been added to the guidelines in recent years.

ATE efforts address all three parts of the recruitment and retention model we presented. Their efforts provide for developing interest in technical education; proper preparation of students, teachers, and staff; and support for persons engaged in the educational program.

Many activities are being used to recruit and retain students in ATE programs. Especially noteworthy are the many collaborative arrangements between colleges and business/industry. These arrangements are key to the success of the ATE program, and, in some cases, are directly responsible for the recruitment and retention of large numbers of students. Testimonials of success and promised success can be found throughout the survey and site visit data. However, *projects* (i.e., projects and centers) have generally not reported actual recruitment and retention rates based on systematic evaluation[s] of their recruitment and retention efforts.

R & R is a major emphasis in all community colleges, and *project* reports often included descriptions of community college R & R efforts outside the bounds of their ATE grants. As a result, it was not always clear whether recruitment/retention activities were supported by the ATE grants or if any linkages existed between ATE *project* efforts and other community college and business/industry efforts.

Both the literature and *project* data suggest that the effectiveness of each R & R method may be enhanced by an array of factors. These factors include the timing of the approach, the degree to which personal and repeated contact is made with the prospective or enrolled student, and the level of expertise to which the student is exposed. In other words: how a message or service is delivered—when, how often, and by whom, will play significant roles.

We make two major recommendations. First, further strengthen, promote, and clarify recruitment and retention objectives in the ATE program guidelines. Describe recruitment and retention as a system rather than individual activities. Emphasize that it is integral to the ATE program to encourage matriculation in and successful completion of the college's technology program. State that the R & R system should provide traditional and nontraditional prospective and enrolled students with needed elements of Information, Preparation, and Support.

Second, make evaluation integral to R & R to document these efforts and accomplishments and/or to identify ways for improvement.

Information to support findings presented in this study are available from the lead author as four documents. One shows NSF-ATE guidelines for the fiscal years 1994-2002 in tabular format for all items specifically worded around the issues of recruitment and retention. The remaining three documents are tables that show how responses to survey questions and site visit report information were categorized using the three-part framework of Information, Preparation, and Support.

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Recruitment and Retention in the ATE Program[4]

Overview

A primary goal of the National Science Foundation's (NSF) Advanced Technological Education (ATE) program[5] is to increase the number of highly skilled technicians in the U.S.'s workforce. ATE uses community colleges as a "pipeline" for this purpose. As the term *pipeline* suggests, NSF and others view community colleges as a conduit for preparing technicians. This conduit provides educational experiences that prepare recruited individuals for highly skilled technician positions in businesses and industries. Recruitment—persuading individuals to enroll in a community college technician program—and retention—keeping students successfully enrolled in the program to completion—are essential to the success of the pipeline.

This paper addresses ATE projects' efforts to recruit and retain students in technological education programs. The paper's purposes are to

- Briefly define and describe recruitment and retention as employed in colleges and especially ATE-based community college programs
- Identify and describe factors key to successful recruitment and retention
- Describe the expectations and actions of the ATE program, and those of funded *projects*[6], in relation to the key factors for recruitment and retention
- Identify and describe strengths upon which the program and its funded *projects* can build and further improve recruitment and retention
- Identify weaknesses that may exist in the current program and make recommendations to effectively address them

We divided the paper into three parts: (a) general context/background, (b) findings from our analysis of data[7], and (c) a discussion of findings. The general context is divided into two parts. First, we describe findings from current literature that helped our understanding of the general background issues surrounding recruitment and retention and the various strategies employed to enhance both efforts. Much of this literature addressed higher education generally, but we paid special attention to those sources that focused on associate-degree institutions. From this literature, we identified three factors (goal commitment, preparation, and support) common to successful recruitment and retention practices. Second, we reviewed and briefly present the ATE program: Congressional expectations for the ATE

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[4] Supporting documentation is provided for the findings from this study. To obtain this documentation visit the ATE Evaluation Project Home page at http://www.ate.wmich.edu. Under Evaluation Products, click on Issue Papers. On that page, click on Recruitment/Retention and then Appendices or contact the authors at Western Michigan University.

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

[6] NSF funds projects and centers. The convention *projects*, in italics, will be used to denote both projects and centers as a group, unless specifically indicated otherwise.

[7] **Data sources:**
Three primary types of data sources were employed in composing this paper:
- NSF-based publications, especially ATE guidelines from fiscal years 1994 - 2002
- Published literature on the topics of recruitment and retention
- Data from two years of this ATE evaluation project's work including
    - Results from two annual surveys of current ATE *projects*, conducted in spring 2000 and winter 2001
    - Information reported from site visits to 13 *project* sites conducted in the late 2000 and early 2001

program, the ATE program's expectations (guidelines) for funded *projects*, and key attributes of the program.

The findings we report come primarily from survey and site visit data gathered in 2000 and 2001. We construct and present a simple framework with three elements (Information, Preparation, and Support) to assess the ATE program efforts. Additionally, we present five case examples from survey and site visit findings to better show some of the methods used by *projects* to reach recruitment and retention objectives.

The discussion following the findings addresses implications for serving pipeline needs. We conclude the paper with several recommendations for further developing and improving the program.

The Recruitment and Retention Context

General Background

Recruitment. The comprehensive nature of recruitment can be found in J. Smith's writing, "The primary goal of recruitment programs and activities is to influence the behavior of prospective students, their parents, and significant others in the college admission process . . . [recruitment can include activities to] (a) generate initial student inquiries and interest, (b) identify serious potential candidates, (c) convert prospects to applicants, (d) convert applicants to deposits, and (e) convert deposits to matriculants" (Smith, 1998).

The commonly known "bread and butter" methods of recruitment include college nights at high schools, scholarship offers, and brochures in the mail. Some other notable methods advocated in current literature include

- Use of outside marketing consultants with 8 percent increase of enrollment noted (Lord, 2000)
- Collaborative inter-institutional practices for written materials, recruitment events, presentations, joint trips or visits, and electronic media with testimonials of success (Stonewater, 1999)
- Active recruitment of high-achieving Black students, especially through offers for paid tuition and room and board, book stipends, laptop computers, guaranteed summer internships or research jobs, and all-expense paid weekends. There is evidence of enhanced reputations for Historically Black Colleges and Universities with more National Achievement Scholars, at times, than Princeton or Harvard (Roach, 2000).
- Use of nontraditional marketing techniques to appeal to Generation Xers with evidence of drastic improvement of name recognition for the institution (16.6% to 94.5%) and first increase in enrollment in seven years (Raisman, 1999)

Some writers used logic models to explain the process students follow in choosing a college. These models provide both a progression of steps and specific factors known to affect recruitment success. Hossler and Gallagher (1987) described a widely accepted three-stage student enrollment behavior model. This model divides the decision process into (a) college aspiration, (b) search and application, and (c) selection and attendance. Coupled to these three stages, Belcher and Frisbee (1999) list 17 factors that influence decisions at these three stages. The factors (as listed by the authors and specific to an automotive program) include (1) friend(s) at university/community college or high school, (2) reading this university's catalog, (3) high school/community college counselor/teacher, (4) parent(s)/relatives, (5) alumni of this university, (6) reputation of automotive program, (7) technology recruitment activities, (8) university recruiters visiting my high school, (9) athletic advisor/coach, (10) admission office at this university, (11) campus visit, (12) reputation of the university, (13) university recruiters visiting my

community college, (14) community in which university is located, (15) bulletin board advertising at my previous school, (16) promotional materials (brochures, letters, videos), and (17) articulation or direct transfer from community college.

Most high school graduates are recruited to higher education. Approximately three-fourths of high school graduates enroll in colleges and other forms of higher education either immediately upon high school graduation or within two years of graduation (Haycock & Huang, 2001).

Retention. *Retention* can be defined as " . . . the maintenance of students' satisfactory progress toward their educational objectives until the objectives are attained" (Dolence, 1998, p. 89). The objective may be a college degree, completion of a program (course sequence) or even a single course required to obtain a job or a pay raise. Especially for community college students the educational objective is likely to be "shorter term" than degree attainment.

Retention is closely coupled to recruitment. Much like the chicken or egg proposition, there can't be retention without effective recruitment. Yet, effective retention attracts applicants. Additionally, ". . . retention rates [are] critical measures of institutional effectiveness" (Moller-Wong, Shelley II, & Ebbers, 1999). Indeed, graduation rate, the sine qua non of retention, is often used as a performance measure for institutions and programs.

Efforts to improve retention rates typically center on freshmen orientation, academic advising, and continued financial assistance. But, information on best retention practices is sparse. Authors tend to focus more on the difficulty of obtaining good retention information than on methods to improve retention.

Three factors contribute to misunderstandings of retention. First, researchers often presume that all students seek a degree. In those situations students, who complete their personal objectives short of a degree and discontinue enrollment, are treated as "drop outs." This yields a depressed retention rate value. Second, terminology is not consistent across writers—a wide array of terms (e.g., persisters, graduates, attainers, transfers, stop-outs, dropouts, and dismissals) is used to refer to students and their enrollment status. Third, students may be completing programs or degrees at various institutions, with discontinuous enrollment, and over an extended period of time. These enrollment variations necessitate longitudinal studies, such as the National Longitudinal Survey (NLS), to accurately determine completion rate (Tinto, 1993).

Despite the difficulties several aspects of retention seem clear.

- Attrition is greatest at the freshman level and declines in following years. Levitz and Noel (as cited in Moller-Wong, Shelley II, & Ebbers, 1999) put the attrition rate in the first year (students leaving their current institution) at about a third overall. Haycock and Huang (2001) noted substantial differences between 2- and 4-year colleges. They found that more than a quarter of those in 4-year colleges and nearly half of those in 2-year colleges do not make it to the sophomore year. The rate of attrition declines by about 50 percent every year thereafter.
- Fewer than half of those enrolled graduate. Several studies put graduation rates in the range of 40 to 50 percent. Moller-Wong, Shelley II, & Ebbers (1999) found that approximately 45 to 50 percent complete their undergraduate degrees. Similarly, for 4-year institutions, Erickson and Strommer (1991, p. 41) found that over the past 20 years, the rate of graduation nationally has been roughly 40 percent in 4 years, not quite 50 percent in 5 years. For 2-year institutions, Tinto (1993, pp. 18-19) found completion rates for full-time students across a 3-year time frame to be 43 percent.

- Overall attrition rates have remained fairly stable for the past 60 years (Moller-Wang, Shelley II, and Ebbers, 1999).
- Attrition is largely due to dropouts rather than forced dismissals.

Key factors for recruitment and retention. Most recruiters argue that they do not strive for a 100 percent retention rate because not all students may be the right fit for the institution (Rummel, Acton, & Costello, 1999). However, we argue that stronger preparation and information programs should provide better initial "fits" for recruits, which should result in higher retention rates. Concomitantly, the reputation and backing of retention programs that offer good quality supports should yield higher recruitment numbers.

The studies and essays we reviewed identify three general factors as important to individuals' decisions to initially enroll and their subsequent decisions to stay enrolled to completion of their planned objective.

- Personal commitment to the goal
- Academic preparedness
- A sufficient support base

Several studies note the importance of educational aspirations and goal commitment. Tinto (1993) and Cope and Hannah (1975, as cited in Moller-Wong, Shelley II, & Ebbers, 1999), especially note the importance of commitment to the academic or occupational goal. Tinto states "The commitment of the student to the goal of college completion had the strongest positive effect on the decision to remain in school." He continues, "Given sufficiently high goal commitment, individuals may decide to 'stick it out' even in unsatisfactory circumstances" (1993, p. 43). Hurd (2000) noted the importance for students to know what they are working toward so that they don't flounder, become frustrated, and leave.

Studies also confirm the importance of addressing those in a position to affect the aspirations of the prospective or enrolled student (i.e., parents, teachers, counselors, academic advisors, employers, administrators, and peers) (Belcher & Frisbee, 1999; Munro, 1981). Munro noted that parents as a group had the strongest direct effect on students' goal commitment (1981). In today's society quite likely housemates or spouses will have a similarly strong direct effect.

Academic preparedness provides educational and work opportunities. The importance of academic preparedness is well known and understood, but not necessarily appreciated by those who most directly influence students (i.e., family, friends, and peers). For young persons whose parents have not completed college or do not hold skilled technology positions, awareness and interest may not be generated in the home. For these individuals, it is especially important to create awareness and interest early in the educational process (e.g., at the middle school level) and for them to gain requisite skills for entry to college. Mulder (1991) concluded that lack of preparedness presents the most severe problems for minority students. These preparedness problems appear to stem from factors such as inadequate curricula, linguistic difficulties, and family concerns. These findings suggest the necessity of special efforts with minority students to assure that they gain knowledge and skills requisite for admission to technology-based college programs.

When the objective is larger than a course or a short sequence of courses, students require a sound support base to stay in school and maintain progress toward program completion. The support-base element captures several variables of importance. Studies commonly highlight a student's financial status as a major consideration for entry to college and staying in college to completion. This appears to be especially important to retention beyond the freshman year with student dropout often related to family

financial problems (Hurd, 2000). Hurd reports that students often stop-out when they meet financial difficulties. The student will leave and work for a year, then come back (p. 44). Two recent studies (Roach, 2000; "UNCF," 2000) especially emphasize the importance of financial assistance from collaborating business and industry partners for technology-based programs. These programs often directly serve minority groups.

Johnson (1997) studied retention rates for commuter student. He found that retention rates for these students are consistent with findings from studies conducted of noncommuter, residential students at other institution. His findings suggest that retention issues are consistent across types of students. His study has particular value because the characteristics of commuter students are much like those of typical associate degree students. That is commuter students usually have responsibilities and pressures such as full or part-time jobs, and family and home responsibilities. These responsibilities and pressures differ from traditional campus-based students.

Several studies note institutional climate as an important support factor for students. It has been noted that most students drop out of school for nonacademic reasons such as personal, social, and financial (Cambiano, George, & DeVore, 2000; Kalsner, 1991). With regard to minority students, Parker (1997) noted the importance of creating "a campus atmosphere where students are presented with a mandate to succeed, not the right to fail" (p. 1). This is also especially true for students with disabilities. Adapted physical facilities and assistive technology devices are examples of an institution's willingness to cultivate an institutional climate that supports *all* students (Malakpa, 1997). Tinto summarizes the matter of support well. He states, "we must . . . avoid the tendency to assume that all members of a particular group have the same interests or needs. Though it is sometimes necessary for institutions to develop programs targeted to the needs of distinct groups of students, it is always the case that program action must be guided by the assessment of *individual* needs" (1993, p. 181).

Some writers, like those cited above, provide individual gain statistics to provide an indication of the impact of a strategy or technique tried. We found no experimental studies (i.e., studies employing a control group) on this topic.

The ATE Program

When the U.S. Congress passed the *Scientific and Advanced Technology Act of 1992* as Public Law 102-476, two incorporated purposes were "To establish a national advanced technician training program, utilizing the resources of the Nation's two-year associate-degree-granting colleges and to *expand the pool* of skilled technicians in strategic advanced-technology fields . . ." [italics added].

The ATE program flows from and responds to the Congressional mandates. Work of the ATE program, in turn, is based upon its published guidelines. To understand ATE expectations for recruitment and retention, NSF-ATE Program proposal guidelines were reviewed for fiscal years 1994-2002. The guidelines were searched for their specific references to recruitment and retention and to underrepresented and/or nontraditional students[8].

This review of guidelines revealed the following:

[8] These references are available from the author, please ask for Appendix A. Additionally, in that appendix we noted if a citation was directed to ATE projects, centers, or generally stated.

1. The guidelines encourage efforts that will increase recruitment and retention, especially by ATE centers.
2. The guidelines have been evolving. This is most notable in the expanded wording with regard to underrepresented and/or nontraditional groups of students.
3. Recent years have seen a shift to more directness about the issue of accountability. For example:
   - Although proposers were always asked to lay out plans for recruiting, now regional centers for manufacturing or IT education (FY 2001) are being asked for mechanisms for measuring numbers of students recruited, numbers retained until competencies are achieved or certifications received, and the numbers of those who partake in internships, etc.
   - Fiscal year 2002 guidelines add "Reporting Requirements" of responding to a survey requesting information about the number and characteristics of students affected by a *project's* activities.
4. Proposers are also being asked (FY 2002) to work with industry partners to address "capacity building (recruitment, retention, and placement of students)" by collaboratively engaging in various activities with students at secondary and college levels.
5. Due to Executive Orders 12876, 12900, and 13021, guidelines under the heading of Budgetary Information for fiscal years 2001 and 2002 have changed by removing the requirement for cost sharing/matching by Historically Black Colleges and Universities (HBCUs), Hispanic Serving Institutions (HSIs), and Tribal Colleges and Universities (TCUs).
6. Although not referenced in the guidelines as recruitment-and retention-related work, several specific methods were suggested that should ultimately lead to more success in these areas (e.g., recommendation to use modern instructional technologies, articulation of courses and programs, professional development).

Locus of Activities

Congress named associate-degree-granting institutions as the primary site for technician training. Additionally, it is repeatedly stated in NSF literature that these institutions should play a leadership role in ATE *projects*. For this paper, we focused on these "community colleges." However, it should be noted that several recruitment and retention methods cited in this paper may have overlapping application to the three primary points of activity for the ATE program: (a) middle and high schools, (b) community colleges and to a lesser extent baccalaureate colleges, and (c) collaborating business and industry locations.

Key Participants

Three key groups participate in the recruitment and retention of ATE students:

- Business and Industry—Business and industry have substantial needs for well-educated and skilled technicians. This key group provides career opportunities and is responsible for establishing entry level and cutting-edge skill and knowledge requirements for careers. This group is increasingly involved in sponsoring all levels of recruitment and retention activities in collaboration with schools.

- Schools—This group, primarily associate-degree-granting colleges and other educational institutions that work collaboratively with them, provides direct educational instruction and programming to develop skilled technicians to serve workforce needs. In addition, this group provides support and information for students.

- Students—*Prospective* students are the individuals being recruited to the identified technology careers. These recruits include (a) those at the secondary school level who are making initial

decisions about career options and opportunities; (b) employees in business and industry seeking to continue their education to increase their options and opportunities; and (c) to a lesser extent, students at the college level who have not yet made career decisions or who are considering changing their career paths. *Enrolled* students are those individuals who have matriculated and are actively engaged in a technology-based program.

Analysis and Findings from Survey and Site Visit Data

We constructed a framework of three elements—Information, Preparation, and Support—to organize the data and synthesize findings. This framework was based on our review of literature and ATE materials and matched to the identified key factors (personal goal commitment, preparation, and support). Both the literature and the ATE work suggest that success requires attention to all three elements. That is, a well-balanced recruitment and retention program enrolls and retains students who are adequately

- Informed about career opportunities and a college's ability to provide a sound educational route to those opportunities
- Prepared to succeed in the program
- Supported by an educational/institutional system in order to reach a successful completion of the program

The following more detailed "operational" descriptions are provided to clarify our basis for categorizing information provided in survey responses and site visit reports.

Information

This element is based on the expectation that sound information regarding educational and vocational options helps to develop and sustain goal commitment aspirations. Although not able to alter the student-related factors directly, college recruitment and retention activities can modulate the effect of these factors by equipping the students, or those who influence them, with accurate and helpful information. Information objectives work in tandem with preparation and support objectives by addressing both preparation requirements and support resources available to students.

For the ATE program, the key aspect of this element is creating an interest in an advanced technology career and the college educational program as a means to that career. The element of Information should communicate the local, regional, or national need for graduates in a specified field with concomitant career and benefit opportunities.

Provided through all stages from preenrollment through program completion, the element of Information identifies work-based opportunities and educational/vocational goals. It focuses on developing and sustaining goal commitment on the part of the student. It also identifies procedural and educational steps needed to attain those goals. Much like basic marketing principles, this element provides potential customers (prospective students) and those in a position to influence them (e.g., teachers, parents, and peers) with increasing levels of awareness about and interest in the product. It is also concerned with retaining repeat customers (enrolled students) by maintaining their level of interest and motivation about the product (chosen advanced technology field) at high levels.

Preparation

The element of Preparation is needed to create a solid educational and experiential foundation. Students use this foundation to make informed decisions and reach their potential. It is not sufficient for students to

be informed only of career opportunities and routes to those opportunities. They must also prepare adequately to navigate the path to their chosen careers. This element

- Is an educationally based element that must begin early for success in any field, not just advanced technology careers
- Requires solid grounding in science, math, and technology along with a bedrock of literacy
- Includes preparation through various experiential methods (internships, work experience, or work study)
- Applies also to those who can influence students—for example, teachers and guidance counselors must continue to keep their skills sharp and be properly prepared to educate and guide prospective and enrolled students

Support

This element focuses on creating and maintaining an environment to attract and keep students. Setting the stage with necessary props—if you will—for success. The primary objective here is solving needs-based issues so that interested students know they can obtain sufficient support to enroll in the program and continue to completion. Examples of needs-based issues include the financial viability of attending college; family responsibilities and family care options; social integration within the college setting; student advising; and the need for Americans with Disabilities Act (ADA) accommodations.

Financial needs are met in a variety of ways, for example, by providing direct support to visit a college campus, scholarships, student loans, paid work experiences and internships, and other aids such as free or reduced costs for child care while attending courses. Institutional (college based) and industry scholarships serve as a primary tool to address financial need. Similarly, as noted in the ATE program description, inter-institutional collaborative and articulation agreements provide a variety of mechanisms to support students.

Though more difficult to measure, support also includes other factors:

- Providing work and study environments that are attractive to and supportive of prospective students (when recruiting) and of enrolled students (when retaining). The environments should be consistent with the work-based opportunities the students seek to obtain.
- Answering supply issues such as availability, scheduling, and locating classes to meet student needs
- Maintaining attractive, modern educational facilities with state-of-the-art laboratory and instructional equipment
- Sustaining a solid reputation through high standards for teaching, content, and certification or graduation from the program

ATE Survey and Site Visit Findings

Using the Information, Preparation, and Support elements as categories, we:

- Reviewed the Survey 2001[9] and site visit data to identify and describe the nature and extent of activities conducted to serve recruitment and retention objectives

[9] Because 96 percent of the sample in Survey 2001 also participated in Survey 2000, which asked the same questions, we chose not to analyze data from the 2000 survey. The analyses used items 13a and 13b of the Program Improvement section of the survey. We did, however, include some Survey 2000 responses as illustrative for this paper.

- Separately analyzed responses to the Survey 2001 recruitment (Program Improvement section question 13a) and retention questions (Program Improvement section question 13b) to assess patterns in the use of Information, Preparation, and Support efforts
- Analyzed site visit data[10] both to gain a general sense of whether these data and survey data provided consistent results and to identify exemplars of recruitment and retention practice

These data provide evidence of substantial recruitment and retention efforts by *projects*, individually and collectively. Tables 1-3 identify and list the various methods employed and represent responses from the majority of *projects* (not all *projects* engaged in recruitment and retention activities). We found that most methods group into several subcategories corresponding to *project* objectives or intended outcomes. We used those subcategories to organize data within the respective tables.

Table 1. Objectives Served and Methods Employed to Address the Element of Information

Objective: Make prospective ATE students aware of, knowledgeable about, and interested in pursuing careers in advanced technology fields.

Sample Methods:

- Career fairs
- Presentations by college representatives
- Presentations by industry representatives
- Tours of college programs or industry
- Career opportunities matrix
- Job shadowing
- Field trips/site visits to industry
- Brochures, catalogs
- CD-ROMS, Web-based audios, videos and printed materials, presentations (e.g., providing overview and interview with industry reps)
- Web sites
- Billboards/radio/newspaper/magazine articles or advertisements
- Conferences on minorities in technology
- Orientation courses
- Contacts through partnerships with local, regional, or government organizations (e.g., public housing authority, native organizations)
- Mass mailings to pools of students–postal or electronic
- ATE *project*-sponsored national high school competitions

Objective: Keep prospective or enrolled ATE students informed of requirements and steps that must be taken to achieve entry to the career, including basic requirements for entry to and completion of a college degree and/or requirements for successful completion of courses and industry or program certification.

[10] We were not able to clearly distinguish and categorize activities as recruitment or retention based.

Table 1. Objectives Served and Methods Employed to Address the Element of Information

Sample Methods:

- Career advisement via school counselors or teachers
- Preadmission counseling – especially for older adults
- Extended video or other instructional options
- Industry-college articulation programs or agreements
- College-secondary school articulation agreements
- Presentations to workers at job sites

Objective: Convey institution's ability and willingness to address needs-based considerations (e.g., financial, academic skills, family responsibilities) so that interested students know they can obtain sufficient support to enroll in the program.

Sample Methods:

- Identify needs (e.g., financial, academic skills, family responsibilities) through needs assessment activities such as surveys; focus groups; interviews with and input from counselors, teachers; family planning; and other community service agencies

- Provide information about these matters (scholarships, student loans, education-employment opportunities, etc.) and ways support needs can be met through brochures, career days, counselor assistance training, and other dissemination media

- Describe access and support for students with disabilities and provide information describing/verifying nature and extent of access and support available

Objective: Make those who are influential to prospective or enrolled ATE students aware of and knowledgeable about educational opportunities and careers in advanced technology fields.

Sample Methods:

- Technical awareness workshops for professionals
- ATE *project* faculty personal visits with high school teachers/counselors
- College counselor training
- ATE laboratory open houses for teachers and administrators
- Technology fairs for community members, including parents and peers
- Industry tours for teachers at all levels of education
- Presentations for parents about course and dual credit options
- CD-ROMS, Web-based audios, videos and printed materials, presentations (e.g., providing overview and interview with industry reps)
- Billboards/radio/newspaper/magazine articles or advertisements

Table 2. Objectives Served and Methods Employed to Address the Element of Preparation

Objective: Create a solid educational basis upon which prospective and/or enrolled ATE students can make informed decisions and reach their potential.

Sample Methods:

- Workshops/seminars
- Tech prep courses/introductory career classes
- STEM instruction in middle and high schools
- "Bridge" or developmental courses to address academic underpreparedness
- Study skills instruction
- Articulated secondary school/college courses

Objective: Create a solid experiential basis upon which prospective and/or enrolled ATE students can make informed decisions and reach their potential.

Sample Methods:

- Summer tech camps
- ATE-related work-study
- Industry-based student internships
- Hands-on interactive jobs for a day
- Real-world, industry-based problem assignments
- Technical Olympics

Objective: Keep teachers and counselors prepared to educate and guide prospective or enrolled ATE students.

Sample Methods:

- Industry-based faculty internships
- Faculty/teacher ATE workshops with certification or other educational credit available
- Technical skills upgrading professional development workshops
- ATE *project*-led activities for special education teachers
- Hands-on interactive jobs for a day

Table 3. Objectives Served and Methods Employed to Address the Element of Support

Objective: Offer solutions for a student's personal considerations.

Sample Methods:

- Accommodations (including attitudinal) for physical or learning needs
- Personal/psychological counseling
- Peer tutoring/college-provided free tutoring
- Positive and encouraging staff and administration
- Mentoring programs
- Programs for those returning to workforce (i.e., homemakers)
- Small class sizes with opportunities for better interpersonal relationship with teacher and classmates

Objective: Offer solutions for a student's practical considerations.

Sample Methods:
- Scholarships, grants
- Convenient campuses, transportation, and course times
- Articulation agreements allowing dual credit at secondary and postsecondary levels and/or enabling easy transfer of course credit among postsecondary institutions
- Job placement
- Child-care facilities
- Laboratories open for extended hours/ Saturdays
- Online courses

Objective: Establish and maintain high quality teaching and content standards to support effective recruitment and retention by ATE programs.

Sample Methods:
- Up-to-date industry-aligned course materials
- Cutting-edge laboratories and equipment
- Sufficient supply of equipment for all students
- Programs well regarded by the community
- Faculty available for individual student assistance
- Technical educators to support and advise teachers in rural areas

Participant responses tabulated by element(s) addressed for recruitment and retention are attached to this paper[11]. The summary results from those tables are provided in Table 4.

As Table 4 shows, 45 *projects* gave us usable/categorizable responses to the Survey 2001 Program Improvement section question 13a, which asked respondents to briefly describe specific steps taken to recruit students to their program. The majority of recruitment efforts appear to focus on providing information to prospective recruits.

Because the literature points out the importance of external influencers (e.g., parents and teachers), we separately categorized Information and Preparation activities in terms of who was the recipient of the information. Nearly all respondents' activities (93%) could be categorized as work to provide information to students directly. Some of the *projects* (26%) indirectly provided information by informing others (e.g., teachers or counselors) who work with the students. Only a small minority reported methods strongly tied to either Preparation or Support (approximately 10% per category). The one *project* reporting indirect preparation provides educational experiences for teachers.

Data for retention findings in Table 4 come from a single question that asked respondents to describe specific steps taken to retain students. Most respondents listed a few (1 – 3) methods, and only one *project* reported many (9) different methods. As Table 4 shows, the majority of reported methods (82%) address the element of Support with relatively few—22 percent and 18 percent, respectively—providing information and preparation-type activities.

[11] All appendices are available from the lead author. Appendices B and C are constructed from the Survey 2001 data, while Appendix D is prepared from the site visit data. Appendix B addresses recruitment efforts; Appendix C addresses retention; and Appendix D, because the site visit reports combined recruitment and retention descriptions, addresses recruitment and retention together. These appendices in table format show which elements receive attention and the extent to which individual *projects* comprehensively address all three identified elements.

While the site visit reports provide substantial detail, they did not clearly establish whether the *project* methods served one objective, recruitment or retention, or were intended to serve both. As a result, the findings for recruitment and retention are combined in the Table 4 summary of site visit results. Additionally, we chose to include all possible recruitment and retention activities identified in site visit reports (i.e., activities were included in our tabulations even if not designated under recruitment or retention headings). The results show that 10 out of 13 *projects* engaged in activities addressing all 3 elements of information, preparation, and support. That finding appears to be consistent with survey data for the categories of Information and Support, but is larger than the survey results for the category of Preparation.

Table 4. The Number of ATE *Projects*' Recruitment and Retention Efforts as Reported in Survey 2001 and Site Visit Reports

	Element(s) Addressed				
	Information		**Preparation**		**Support**
Source	General or Direct*	Indirect **	General or Direct	Indirect	
Survey 2001 Program Improvement Section					
Number of *Projects* listing recruitment efforts for Item 13a (n=45 *projects*)	**42**	**12**	**5**	**1**	**5**
Number of *Projects* listing retention efforts for Item 13b (n=49 *projects*)	**9**	**2**	**8**	**1**	**40**
Site Visit Results					
Reported items related to recruiting/retaining students (n=13 *projects*)	**10**	**7**	**9**	**12**	**11**

Notes: Any one *project* may have reported several specific activities or methods that fit into an individual category. A *project* was counted only once, regardless of the number of activities it listed.
* General or Direct indicates activities that have either a general application to multiple audiences or to prospective ATE students only.
**Indirect indicates activities that are intended to reach those who are in a circle of influence to the prospective ATE student.

Case examples. Tables 1-4 identify a wide array of recruitment and retention activities, but they do not provide many details that show the full power of the various methods. To more clearly depict the particular emphases of *projects* and their attention to Information, Preparation, and Support aspects, five case examples are presented[12]. These cases show recruitment and retention from quite different vantage points. One shows the strong relationship of an ATE *project* with the needs, influence, and support of business and industry and its effect on student recruitment. A second shows a comprehensive, systematic approach by a community college that focuses most heavily on retaining students in the program. The third describes community college students serving as mentors to high school students, effectively melding technician programs in secondary schools with an associate degree program. The fourth addresses use of community organizations to recruit and retain underrepresented groups. The fifth provides an abbreviated analysis of a *project* that has not met recruitment expectations and factors that have deterred its recruitment success. All directly quoted information is from the WMU evaluation project's site visit reports or survey responses, with permission from principal investigators related to the

[12] Three of the examples are drawn from site visit reports; one is taken from Survey 2000 data, and one is prepared from a separate site visited because of apparent recruitment problems.

cited *projects*. In keeping with commitments made in obtaining access to these sites, site-specific names are omitted and referred to by number (e.g., Site 1).

Site 1. Welch & Gullickson (2001) described how this college engages in a variety of collaborative efforts with industry. Four examples are briefly described. The first shows industry involvement in awareness and preparation activities. The remaining three show recruitment via special types of collaboration, each with a specific goal and identified group of individuals. In each instance, the industry partner is integral to the educational program offered and participates fully from the inception of the idea through completion of the process. This report is paraphrased below.

1. Awareness and preparation activities.

   In collaboration with Nortel, a summer tech camp was held that focused on wireless technology. Two 3-week camps were held. Fifty-seven students completed them. Approximately two-thirds of these students received their amateur radio licenses during or after the camp. Nortel provided $34,000 and nearly 60 mentors to help support the camps. Other corporate sponsors included Southwestern Bell, Kimley-Horn, and Sunbelt Plastics, Inc. Separate workshops and seminars have been developed and presented to middle school teachers, students, and parents both at two additional locations, a college and a community college

2. Industry certification courses.

   This community college has become one of the major certification sites in the U.S. for Cisco Systems, the world's largest producer of Internet hardware and software. Cisco developed the curriculum, and this site has been authorized to offer the classes (Cisco calls them academies). The site is one of six institutions in the nation to offer advanced Cisco Systems training leading to a Network Professional certification. Currently, some 700 students are enrolled in Cisco classes.

3. Technician retraining.

   The College offers off-campus programs in conjunction with several industries including Alcatel, MCI World Com, ST MicroElectronics, and Southwestern Bell. These businesses and industries support participation of their employees to update technician skills. Through a series of courses participants, gain requisite technician skills in hardware-based telecommunications industry. The program prepares participants to move to higher skilled positions in the industry. The courses are provided at the industry site or campus depending on availability of equipment and course instruction facilities. The College is currently offering 20 on-site classes that enroll about 300 students. A full-time staff person has been hired by the Division of Engineering Technology to respond to these industry needs.

   One collaborative enterprise is a program of studies for employees of an individual company. This program provides a sequence of 10-week courses, followed by 2 weeks off for a period of 2.5 years. Most instruction occurs on Saturdays. The instructor travels to the collaborator's site to provide direct instruction. Students come to the College to use its equipment for required course labs. The collaborator pays tuition and book costs for participants. Most participants in this program started as production floor workers. Some now work in manufacturing hardware (equipment to provide telephone dial tone). The program is directly targeted at development of technician skills and is quite challenging.

4. Engineer retraining.

   The college was approached by industry to train degree-holding engineers. The company provides the facilities and software needed and pays employees while they participate in the class. This is not a degree program but rather an effort to "re-tool" the engineers. The program is expected to continue for three to five years.

Site 2. This community college developed an extensive 4-phase system that Sterry & Schwabenbauer (2001) outline in their site visit report for the ATE evaluation project. This report has been edited to accommodate updated information provided by the *project* PI. Edits are enclosed in brackets [ ].

> Phase One—During the first semester that students are in the program, they are introduced to a series of new project-based, competency-driven student-learning modules that introduce career options and the work of engineering technical professionals. These learning projects are set in a "hands-on" environment that simulates authentic industrial learning situations. Students are introduced to "softer skills" such as working in teams, written and oral communication, and learning to analyze and solve real business problems.
>
> First semester students also learn how to use basic industrial equipment in the laboratory settings at the new Reynolds Technology Center. This new $8.1 million facility, which opened in mid 1998, houses many of the laboratories and classrooms that are used to deliver Engineering Technologies Division programs. These modern facilities are clean, orderly, and extremely well maintained. This environment provides a positive atmosphere for student learning and is representative of laboratories in modern technology focused industries.
>
> The Phase One experience is, in part, intended to motivate students to select an area of study and stay in school. The college just completed its first semester of this new approach to learning for Technology students, and based on discussions with students, the initial feedback on Phase One and the entire program was very positive. [Student retention has improved well above the current rate across the College.] Since many students tended to leave school after their first semester, the expectation is that this class will help to motivate and encourage students to continue on to graduation. Another factor that may have contributed to the higher retention rate is a more careful screening of incoming students.
>
> Phase Two—After the initial core semester when all the students take a similar program and have learned team building, communication skills, critical thinking, and problem solving by working in an industrial laboratory environment, they select a major field of specialization, but spend much of the next three semesters working on core content that ranges across specializations. Students study in areas such as computer-aided design, CNC, electronics, fluid power, material fabrication, manufacturing, quality, and control systems.
>
> Again, in these Phase Two classes, students work individually and in teams. The real advantage is that during their first semester core classes they learned how to work with team-based activities. As a result, they are capable of learning technical specialties and functioning in an industrial work environment.

Phase Three—This is a single semester employer-paid internship. The College carefully screens employer programs to be sure they are providing high quality learning experiences for the students with opportunities to formally integrate academic competencies with a work experience.

There is very careful monitoring of student performance during the internship experience. Students must apply for a position and be recommended by a faculty member. They submit a resume to the employer and go through the same interview process that the company uses for all applicants. A school intern advisor works directly with the student intern and the employer in planning, monitoring, and assessing the results of the internship experience. Advisors also visit students on site to monitor performance throughout the internship.

Employers also agree to rate the student performance after the internship in areas such as quality of work, technical skills, people skills, communication, individual initiative, and contribution to company goals.

Phase Four—In this Capstone experience, usually in the last semester of the program, students select and work in teams on a project that often comes from their internship experience. They work to solve real industrial problems. This experience provides for application and reinforcement of knowledge, skills, and attitudes learned earlier in the program. The overarching outcome of the Capstone experience is to engage students in applied research, identify best practices in the laboratory, and deploy the most promising back to business and industry.

During the Capstone project, students learn to select team members with different skills required to deal with the problem. For example, computer-aided design skills are needed for conceptualizing and designing system solutions, electrical and electronics skills for the controls, and manufacturing skills for mechanical and quality assurance. As in any industrial or business environment, students learn that it is not just our individual performances and knowledge that matter, but that it is the combined ability of a team with the right mix of skills that really makes the difference in solving real-life problems.

Industrial partners have focused on outreach by helping to market the benefits of the program to the communities in which they operate, including middle schools and high schools of the region. A special industrial advisory committee has been established to work with marketing the program. Industrial partners have also been helpful in providing scholarships and internship opportunities for students.

Outreach and targeted recruitment have been directed at high schools and middle schools to advertise the new program. Perhaps the most innovative effort was the summer science, math, and technology academy initiative for students from area schools. [In the academies, 8^{th}-10^{th} grade students spent 2 weeks on campus during the summer and had opportunities to participate in teamwork and multiple career field experiences.] The Project believes this is a particularly important time to reach students to make them aware of career opportunities that are available to Engineering Technologies Division graduates.

Students are provided the usual counseling, tutorial, and advisement assistance. With the new program of integrated communication, mathematics, and science, students

find learning to be meaningful because of the application to technology projects. The broadly based, hands-on experiences provided in Phase One of the program help students to be successful as evidenced by the improved retention rates.

Administrators and faculty members believe that better student selection will help to improve student success by creating a better "fit" between the program and student abilities, interests, career goals, and learning styles.

Site 3. This project offers a unique approach to keeping students informed, prepared, and supported. The site visit report by Lavoie, Igoe, and Keiser (2000) gives a detailed presentation of this system of recruitment and retention. This report has been edited to accommodate updated information provided by the *project* PI and specific college names have been removed. Edits are enclosed in brackets [ ].

> [The] . . . primary goal of the project is to create an articulated environmental technology curriculum at the secondary level that adds to the already established environmental technology four-year degree, two-year degree, and year-long certificate programs offered at the community college [and two collaborating collegiate institutions]. [This] . . . ATE project intends to meet this goal through three related goals. The first goal is curriculum development and the creation of articulation agreements between the Community College and the high schools served by the College. The second goal is to develop and implement a mentor/mentee program that provides high school students in the articulated environmental technology curriculum with field experience as they shadow community college students in internship experiences. The third goal supports the curriculum development, articulation agreements, and mentoring program through a summer professional development session called “Summer Institute 2000” and follow-up workshops.
>
> We [site visitors] believe that the project also has the goal of strengthening relationships with local high schools and industry and, ultimately, of recruiting more students to the Community College.
>
> According to documents and the PI, faculty, and administrator interviews, other collaborating institutions include businesses, industries, and town and state government offices in the area. Individuals from these institutions serve on an advisory board related to, but not exclusively for, the project. The board includes representatives from environmental technology industries in the area, high schools, and four-year colleges. The board primarily guides [the community college’s] course content, suggests courses to offer, and also makes recommendations for secondary-level tech prep course content. Many of the institutions on the board are also internship sites for [the community college’s] environmental technology program and some, therefore, have hosted high school mentees. The PI also regularly collaborates with local institutions, which may or may not be members of the board, as she coordinates the environmental technology program internships. She uses these to guide tech prep course curriculum decisions and to market the mentor/mentee program. There are over [50] internship locations (eight of which were involved in the mentor/mentee program). The project also collaborates with an ATE center, by using the competencies developed by the center for environmental technology education to guide the tech prep course development.

The following description of the mentoring program is based on interviews with the PI, past and present mentors and mentees, and the Internship and Shadowing Coordinator. Mentors, who are internship students at [the community college] for its environmental technology program, are trained by the [the community college's] mentoring expert from the Business and Industry Council. Mentors then describe their internships to the high school juniors in the environmental technology program, and the school matches mentor/mentee pairs based on common work interests. Each mentor typically has two mentees. The mentors guide their mentees in completing a class research project in environmental technology, and they spend at least one day together at the mentors' internship sites. The relationship lasted one semester the first year and has been changed based on mentor and mentee feedback to last from October to May this year. At the end of the mentoring experience, all mentors and mentees participate in and exposition where students present their projects. Mentors are paid a stipend from the grant.

All three-project goals help the community college recruit new students into its environmental technology programs by spreading the word about the programs to high school students and offering them college credit for articulated high school courses.

The ATE grant provided the funding for the project's professional development activities—the four-day Summer Institute and its follow-up meetings. The project goal of providing a professional development experience to explain the mentor/mentee program and articulation agreement process for the three tech prep courses to the local high school teachers was met.

As a result of the ATE funding, the project established the mentor/mentee program, placing fifteen high school students with eight mentors the first year and placing ten students with five mentors the second year. The high school students received advising on their environmental technology research projects and visited the mentors' internship sites as a result of the program.

The strengths of the mentoring program are its advising impacts on the mentees and leadership impact on the mentors. The mentees consistently state that the experience helps them with their projects but mostly helps them learn more about their interests and the jobs available in different areas of environmental technology and other sciences. A few new mentees expressed the hope that they will learn more specific techniques in the field as a result of working with their mentors at their internship sites. The students were mature and well spoken as they discussed their participation and learning in the program. The mentors reported that the program gives them the opportunity to share their knowledge and expertise with others and to expand the understanding of environmental technology education in the community.

The mentoring program is successful because it is integrated into the curriculum, with a research project required for a class as result of the mentoring experience. The teachers support and promote the program and have invited mentors to visit with their mentees at the school during class-project time this year. The mentors are committed to making a difference in the lives of students and to sharing their excitement about their environmental technology internships. Although they are paid a stipend, two of the mentors donated their stipends to scholarship funds last year, and one mentor is trying to procure a laptop computer for his mentee who is a disadvantaged student.

> Internship sites mostly support the exposure of mentees to the industry as well. The mentoring program also benefits from the already established internship program at [the community college].

Site 4. This project demonstrates a dedication to traditionally underrepresented groups of students for advanced technology fields. The ATE survey respondent described this *project* as serving students who are "virtually all . . . disadvantaged in some way" (2000). His words from the survey are captured here.

> The program relies on community organizations for students for the program. This is essential because many of the participants have not been well served by formal institutions of education and would not be responsive to recruitment by community colleges. The community organizations also provide case management and support services, which are critical to helping students stay in what is to them a very rigorous program. The community organizations work with the community college to help program graduates find jobs with local companies and enroll in associate degree programs at the college. They also provide follow-up support to ensure that students are advancing both in their education and careers.
>
> The staff of the partner community organizations provides intensive case management to each participant in the program. . . .This intensive one-on-one support is critical to enabling these educationally and economically disadvantaged students to stay in the program.
>
> The community college and community organization together have built very strong relationships with local employers. Representatives from local companies were extensively involved in the development of the curriculum to ensure that it meets their needs and continue to monitor the program's performance and make suggestions for improvement. The community college organizes special seminars and other events for students in the program to introduce them to the college's technical programs and assist students with placement testing, GED preparation and financial aid applications before the students complete this developmental program.

Site 5. This project serves an isolated region of the country, and had an especially compelling story/problem. This project is funded for three years and is now in its second year. As proposed, the project will develop a specialized technician associate-degree program. In developing his request for NSF funding, the project director obtained commitments of interest from across the state and strong institutional commitments as well. Yet at the beginning of year 2 of the grant, only 4 persons have enrolled in the 20-opening program. The enthusiasm and hard work of the project director, the large number of commitments by others, combined with the small number of enrollees, raised questions about recruitment. Why is it that such efforts go "unrewarded?" Why is there not a waiting list of persons hoping to enter the program? The visit by Gullickson to the site addressed those questions and brings to light some but certainly not all the underlying causes. At the of the site visit, no project evaluation work had been initiated. Contractual problems had delayed initiation of the evaluation by several months. Additionally, follow up of the project's recruitment efforts is not a part of the evaluation expectations.

Here are some of the factors elicited from the project director:

1. Commitments made by the institution were not fully honored. For example, the director was promised instructional space for the program, but when the project was approved the space had already been assigned to a different program. This made it necessary for the project director to spend considerable time and energy obtaining and preparing other space options.

2. This program built upon several existing courses but required development of a large number of new courses. By the time of the site visit, the project director had prepared 10 courses and received institutional approval for their use. He is currently preparing an additional 4 courses; bringing the total new direct- and laboratory-instruction courses to 14. Each course requires substantial development time and effort. Each must go through a prescribed institution approval process, which includes such things as preparation of a course syllabus, identification of viable textbooks, departmental approval, etc. These courses must be approved as part of approval of the full program. Of course, a course must be approved before it can be taught. Currently approved courses (i.e., courses in existence before start of the project) also need to be modified or replaced by newly developed courses to fully fit the new program's degree requirements.

3. Many students who desire to enter the program do not have the requisite skills. Here the difficulties are more than "skin deep." That is, for many or most of the interested students their skills are not sufficiently strong for direct entry into the program. Additionally, for many, their skills are sufficiently lacking that they cannot be corrected through a single course or brief summer program (Two of the four who entered the program in year two are not well prepared and are struggling to succeed). Rather, these students need much stronger math skills, which must be developed through high school programs. In the project director's perception, the students' math deficiencies are sufficiently large to require pointing to this type of program at the beginning of high school so that students obtain the requisite background through a regular course of study in high school. This requires a substantial change in students' understanding and concomitantly counselors' and teachers' orientations at the middle school and high school levels.

4. The program prepares students for a new occupation, one that is not currently listed in the state's directory for employment. This has direct implications for recruitment in that the job listing is not available in materials regularly shared by the state offices with high schools, employers and others. That the occupation is not listed stems from the fact that this specialized industry's demands are changing. In part, the work is now being done either by unqualified persons or those who have 4-year baccalaureate degrees. Approval of a new category seems vital to changing industry habits and bringing the option to employers and employees. It is also vital as a recruitment tool to show employment possibilities for graduating students and encouraging high school students to obtain proper mathematics preparation.

5. The project is minimally staffed. Almost all responsibility falls on the project director. He has handled planning, development, and most implementation with some instructional help by other professionals for short courses. He also obtains assistance from up to four associate-degree student assistants. Adding to the weight is the fact that the project director must also learn new methods and techniques in order to teach the newly approved courses. The program has received approval for hiring a new staff member. However, the approval is for one year only, with continuation contingent upon viability of the program. The new staff member cannot be brought on board before the third and final year of the project. As such, it serves as a springboard for continuation, but the person will not arrive in time to provide much needed assistance in the developmental efforts for the project.

6. Recruitment to the program did not begin in a timely manner. Courses were developed and approved for the program's first year before recruitment efforts began. Information was therefore sent late to high school counselors and others who could effectively direct students' attention to the program and assist/support their preparation for and application to the program. Information was not delivered until near the end of year 1 and/or the beginning of year 2 of the project. Then,

other events (e.g., September 11, 2001) distracted people from the message. Additionally, at the time of Gullickson's meeting with the project director, steps had not been taken to follow up with the recipients of the message to determine if the information had been received and effectively used, and whether there were other steps that might be taken to improve the viability of the message for increasing student applications to the program.

Discussion

As stated in our opening paragraph, the path from school to employment in business and industry is commonly referred to as a pipeline. Traditionally, a generic educational pipeline process could be viewed in the following way: Secondary schools play a role at the beginning of the pipeline, preparing prospective students; associate-degree-granting and baccalaureate institutions recruit and retain these students in their educational and training programs; and business and industry step in at the end of the pipeline as employers of graduates.

Applying this concept to the ATE program, we consider the pipeline as a conduit for engaging students in an educational and training process that prepares them for positions in technologically intensive work in ATE-related positions in business or industry.

However, even though the process remains the same in some ways, it has changed significantly in scope and complexity. Secondary schools are no longer the sole source of prospective students. Now, for technology-based programs, there are multiple sources from which individuals are recruited into this pipeline—secondary school students, current business and industry employees, college students undecided on their careers, and adults seeking reentry to the workforce. Even though associate-degree-granting institutions continue to provide the core educational programs for ATE fields and as such continue to play the primary role in recruitment and retention issues, collaborative arrangements (e.g., articulation agreements) may involve various parties. For instance, students may earn credit for college programs while still in secondary schools or while employed in business and industry. This increases their exposure and experience with ATE material and facilitates access to an advanced technology degree.

Persons already employed by business or industry may have the opportunity to move into more skilled positions as they progress through the educational process of technology education programs. In that regard, placement too has changed from being simply the hiring of persons to fill technology positions to one in which many current employees are "relocated" to positions requiring greater technology skills. Business and industry are no longer entrenched solely at the output end of the pipeline. Instead, they actively engage in recruitment and retention efforts for their employees as well as other prospective employees. As this description suggests, the boundaries of the pipeline have blurred as secondary schools and higher education overlap at the recruitment-retention boundary, and business and industry now overlap at all stages. We believe the methods employed by ATE *projects* for recruitment and retention reflect these pipeline changes. The details of our four case examples demonstrate the degree of involvement of business, industry, and other community organizations in the process of technology education.

The 3-stage enrollment model of Hossler and Gallagher (1987) expanded with 17 factors by Belcher and Frisbee (1999) seems viable when considering the decision process as simply one of college choice that is made by students enrolled in secondary schools. However, today's prospective ATE students are a heterogeneous group. This group requires an enrollment model that (a) addresses student entry into a program from a work-based situation; (b) includes participation by business and industry representatives as key stakeholders in the process; and (c) focuses clear intentions to inform, prepare, and support students seeking advanced technology degrees or certifications.

Our survey and site visit data bring forward important information for *projects* that seek to develop and/or improve their recruitment and retention efforts. Tables 1-3, for example , list many methods that *projects* can employ to serve these objectives. The case examples additionally provide extended descriptions of several methods.

The survey and site visits have quite different bases and therefore provide different information. The survey sample is census like and provides data from nearly all funded *projects* in place for a year or more. The site visits were conducted at a judiciously selected set of 13 *projects* to represent both good examples of *project* work and diverse characteristics of the *projects*. The survey findings, therefore, more accurately describe the full population and indicate the nature and extent of work that *projects* identify as recruitment and retention. The site visit reports, though less viable as descriptors of the population of projects, add support and substance to the survey through their contextual information and extended descriptions of *project* activities.

For two of the elements, Information and Support, survey and site-visit findings were compatible. That was not true for Preparation. Our site-visit findings show more recruitment and retention efforts for Preparation than were reported by the *projects'* survey respondents. Since our site visit to 13 *projects* identified nearly as many Preparation methods as reported by all *projects* in the survey, it appears that our analysis gives greater credit to this category than do *projects* themselves. This is probably due to our purposeful inclusion of professional development as an indirect preparation element that supports recruitment and retention. Additionally, we believe the reputation of well-trained and knowledgeable educators is a strong attractant for students.

Several aspects of survey and site visit findings suggest the viability of the ATE program's recruitment and retention efforts. First, *projects* engage in recruitment and retention activities that are consistent with those recommended in the literature. As such *project* efforts seem appropriate and likely to serve well (i.e., they have face validity). Second, in similar fashion some projects report increases in their student populations. By itself it is not proof, but it does suggest the program is having an impact. Third, the *projects* have developed substantial numbers and types of collaborations with business and industry partners. Business and industry support from these relationships likely improves students' understanding of technicians' roles in these fields and increases job opportunities for persons who complete the respective certification or degree programs. These points are not sufficient to claim success for the programs' recruitment and retention efforts. Both comparative studies and longer term trend data will do much more to buttress the current tentative indicators.

Most of the reported recruitment efforts focus on the element of Information, with limited work applied to Preparation or Support elements. In contrast, most retention efforts address Support, with limited attention to either Information or Preparation elements. When looked at as a single recruitment/retention entity, these findings suggest that *project* actions parallel our own expectations that recruitment will focus more heavily on providing information, and retention will give greatest attention to support, with preparation (which is also the goal of the program) maintaining a visible presence throughout.

Finally, site visit information indicates that many recruitment and retention activities coincide with NSF-based efforts but are not part of the funded NSF projects. As such it can be argued that the recruitment and retention achievements are not due to NSF support and NSF should not lay claim to them (e.g. in reports for the Government Performance and Results Act [GPRA]). Yet, it is clear that projects can and do leverage the coincident efforts to serve *project*-based purposes. In these regards both the local community college and NSF objectives appear to benefit.

Conclusions

1. NSF's guidelines for funded *projects* consistently encourage the development of programs that recruit and retain groups that have been traditionally underrepresented in technology positions. Stronger and more specific language regarding accountability has been added to the guidelines in recent years.

2. ATE program efforts address all three parts of the recruitment and retention model we presented. Its multifaceted goal may be articulated in the following manner:

    - Interest prospective students in ATE courses, certifications, or degree programs
    - Keep ATE teachers, staff, and advisors trained and prepared to educate and support students
    - Prepare prospective ATE students through educational and experiential opportunities
    - Offer avenues of support that meet the student's needs to such an extent that the enrolled student persists in the courses, and certification or degree program until ultimate employment or advancement in an ATE field

3. Many activities are being employed to recruit and retain students in ATE-funded instructional programs. These methods appear to be substantial and likely to produce good results. Especially noteworthy are the many collaborative arrangements between colleges and business and industry. These arrangements are key for the success and survival of the ATE program. In addition to being integral to a *project's* materials development and sustainability, in some cases the arrangements are directly responsible for the recruitment and retention of substantial numbers of students. This may include outreach to nontraditional students by bringing educational programs to employees and thereby upgrading their technology knowledge and skills.

4. Concomitant to use of the recruitment and retention methods is the importance of strategic planning to employ these techniques in timely and effective ways. As the one case example shows, actions delayed may result in substantially lowered applications to the program.

5. Testimonials of success and promised success can be found throughout the survey and site visit data. We found many exemplars (e.g., 350 middle and high school students visited campus on one day, or the course enrollment has doubled) that testify to the productivity of various activities. Generally, however, *projects* have not reported systematic evaluation of their success in recruitment and retention.

6. It was not always clear whether recruitment/retention activities were supported by or otherwise linked to the ATE grants, or if any linkages existed between ATE *project* efforts and other community college and business/industry efforts.

7. Within the ATE program we identified a broad range of activities that we see as affecting recruitment and retention. This range of activities is important because recruitment and retention are not only interrelated, they are inseparable from the primary functions of all educational institutions. Not surprisingly, site visits show these interrelationships and functions much better than do survey findings.

8. Both the literature and *project* data suggest that the effectiveness of each R & R method may be enhanced by an array of factors. These factors include the timing and timeliness of the approach, the interpersonal nature and extent of the contacts, and the level of expertise to which the student is

exposed. In other words, how a message or service is delivered, when, how often, and by whom, all will play significant roles.

Recommendations

1. Further strengthen, promote, and clarify recruitment and retention objectives in the ATE guidelines

    - Strengthen ATE guidelines to encourage all *projects* involved in direct ATE student education to build strong recruitment and retention programs
    - Promote the development of recruitment and retention as a system of interrelated activities that keeps all stakeholders (i.e., students, employers, educators, administrators) aware of responsibilities, opportunities, and outcomes
    - Clarify recruitment and retention as a system rather than individual activities. Emphasize that it is integral to the ATE program to encourage matriculation in and successful completion of the college's technology program. State that the R & R system should provide traditional and nontraditional prospective and enrolled students with needed elements of Information, Preparation, and Support.

2. Require evaluation to document recruitment and retention efforts and accomplishments and/or to identify ways for improvement.

    - Establish key questions and indicators for use by internal or external *project* evaluators to

        a) Increase accountability for funds expended (by confirming that recruitment and retention efforts are productive)
        b) Gain information that can serve recruitment and retention efforts. For example, brief surveys can be tailored to identify students' support needs

    - Consider including evaluative methods such as the following:

        a) Use longitudinal tracking approaches to better understand the retention rates of ATE students. For example, class size for courses can be tracked across terms or years. A random sample of students can be identified on entrance to the program and their progress tracked as they work toward completion of personal objectives. Such tracking efforts need not be extensive or onerous to provide valuable feedback to the project.
        b) Use student focus groups to keep ATE *projects* in line with student expectations and vice versa.
        c) Identify student objectives as part of student application data to plan for success and to encourage students' persistence.
        d) Use a specific time frame and breakout retention and completion rates by major types of student objectives (e.g., degree, program, or course sequence).
        e) Use a checklist of commonly understood recruitment and retention activities on future surveys to better assess *project* status

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