MONOGRAPH

Recruitment & Retention of

Engineering Technology Students

**South Carolina Advanced Technological Education
Center of Excellence**

South Carolina Technical College System

June 2000

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Monograph Introduction

South Carolina, like much of the nation, is experiencing a tremendous growth in high-tech industries. More than 15,000 technology-intensive jobs are unfilled in the state, according to the SC Technology Alliance. With an explosion in industry investment and expansion in the state, more engineering technicians are being sought to meet the increased industry need. Rather than keeping up with demand, engineering technology programs are falling behind in producing the needed graduates. More students must be recruited and retained through engineering technology programs in a way that better meets the learning needs of students and workplace needs of employers.

The mission of the South Carolina Advanced Technological Education (SC ATE) Center of Excellence, funded in part by the National Science Foundation, is to increase the quantity, quality and diversity of engineering technology graduates through the state's 16 technical colleges. The Center is achieving that mission through programs of faculty development, curriculum reform and program improvement. An integrated, problem-based curriculum, interdisciplinary teaching strategies and extensive use of active learning techniques form the cornerstone of SC ATE's efforts to recruit, retain and graduate more students in engineering technology programs.

This monograph presents the results of two research studies and focus group and panel discussions on recruitment and retention of students in engineering technology programs at the two-year college level.

Identifying strategies to assist with recruitment and retention of engineering technology students—particularly women and minorities—was the focus of a 1998 Retention Forum, held in Columbia, SC, and sponsored by the South Carolina Advanced Technological Education (SC ATE) Center of Excellence. The Center is funded by the National Science Foundation and the South Carolina State Board for Technical and Comprehensive Education.

Approximately 90 Retention Forum participants discussed results from research on enrollment and retention of engineering technology (ET) students in South Carolina's technical college system. The SC ATE Center of Excellence commissioned the research report, *Determinants of Enrollment and Retention in South Carolina Engineering Technology Program*s, by Dr. W. Douglas Evans. Forum participants also heard a report on what SC technical colleges are doing well to recruit and retain women and minorities in ET fields. During the forum, a panel of women and minority ET students from South Carolina technical colleges shared their perspectives and experiences. In conclusion, participants met in focus groups to discuss new ways of enhancing recruitment and retention of engineering technology students.

These research activities reveal some significant findings, which are being used to develop new retention strategies. In addition to an in-depth examination of opinions and attitudes of first- and second-year engineering technology students and engineering technology faculty and administrators, the research takes a closer look at recruitment and retention of women and minority students. The various components of this research activity by the SC ATE Center of Excellence are presented in this monograph.

Section 1
Determinants of Enrollment and Retention in South Carolina Engineering Technology Programs
By Dr. W. Douglas Evans

Executive Summary

This study investigated enrollment and retention of engineering technology (ET) students in two-year associate degree programs in order to design program strategies to improve the quantity, quality, and diversity of graduates. Specific objectives were to:

- Identify conditions affecting all ET students' enrollment, persistence and progression into ET careers, especially conditions affecting female and minority students;
- Isolate factors associated with ET student enrollment, persistence and attrition, and identify systemic barriers to and supports for persistence;
- Compare and contrast these factors for all ET students, but especially for female and minority students; and,
- Develop specific recommendations for a strategic plan to improve recruitment and retention for all South Carolina ET students.

Informed by national research and lessons learned from state and local institutional research, the South Carolina Advanced Technological Education (SC ATE) Center of Excellence, assisted by a research consultant, designed and executed the study during the 1997-98 academic year. Surveys of first- and second-year ET students were conducted in the fall of 1997. A survey of ET faculty and administrators was conducted early in 1998. Students and faculty at all 13 South Carolina technical colleges with ET programs were included in the sampling frame. Student samples were drawn based on enrollment in entry and upper level ET courses.

Research findings included important differences in attitudes, behaviors and future plans based on student demographic characteristics. Key results included the following:

- Students who had taken ET courses previously felt much more academically prepared than students who had not;
- More second-year than first-year students reported taking at least one remedial course before enrolling in an ET program (remedial course taking may promote retention);
- First-year, traditional college-age students (17-24) were more likely than older students to report "ET programs were too difficult" as a reason they and their peers would choose not to enroll;
- The vast majority of entering ET students report "completing an ET degree at their college" as their main objective, but after one year of study most ET students report "transfer to a four-year institution" as their main objective;
- Fewer second-year than first-year students preferred applied or "hands-on" instructional methods (which may reflect that lecture methods still predominate and students who persist are comfortable with these methods);
- There was no evidence that student perceptions of ET program quality, student support and facilities are associated with persistence;
- "Instructors" were the most important factor in female student choice of specific ET courses and continuation once enrolled;

- More male than female students are motivated to study ET by economic factors such as getting a better job;
- More second-year than first-year students reported a very good or excellent relationship with their ET instructors;
- More second-year than first-year students were employed and were employed in fields related to their ET major (if any);
- More minority than white students reported that student services and financial aid would be critical to their continued enrollment in ET programs.

The faculty and administrator survey had a low item response rate on questions concerning involvement in campus recruitment and retention programs, and opinions about students and possible program interventions. This suggests many faculty may not be sufficiently involved in these activities. Key faculty and administrator results included the following:

- Faculty were highly in favor of workplace learning opportunities and believe these were the most effective methods of increasing retention;
- They reported past and present ET work experience were very important factors in ET program persistence;
- Lack of academic preparation was the most important reason for ET student drop-out;
- Faculty believed 51-60 percent of students were not sufficiently prepared for their ET programs;
- Lack of technology background was the most important factor in lack of preparedness;
- Faculty believed gender and ethnicity were not important factors in student persistence;
- Preferred recruitment methods centered on faculty outreach to high schools and summer ET instruction for high school students;
- Preferred retention methods centered on work-based learning opportunities.

Recommendations included conducting a follow-up study using these data on student attitudes, behaviors and future plans and enrollment outcome data to identify actual determinants of persistence and completion. Recommended program strategies were organized according to audience: faculty, administrators, student services, employers and statewide marketing.
Promising strategies included the following:
- Orienting faculty to important student attitudes, and involving faculty and administrators in recruitment and retention planning and activities;
- Disseminating information about ET program benefits to specific target audiences;
- Involving business and industry in retention planning and activities;
- Reviewing student services and financial aid procedures and revising as necessary; and,
- Conducting recruitment by outreach and dissemination using tailored strategies for a) students in high school, and b) older students working and in the community. Section V of the report provides detailed recommendations based on specific findings.

I.   Introduction

In 1997, the South Carolina Advanced Technological Education (SC ATE) Center of Excellence began developing strategies to improve statewide enrollment, persistence and graduation of engineering technology (ET) students, particularly female, minority and other underrepresented student groups. Consultant Dr. W. Douglas Evans developed this study of ET student enrollment and retention.

The study's overall goal was to assess South Carolina ET student recruitment and retention in order to design feasible strategies to improve the quantity, quality and diversity of the state's ET graduates. Specific objectives were to:

- Identify conditions affecting all ET students' enrollment, persistence and progression into ET careers, especially conditions affecting female and minority students;
- Isolate factors associated with ET student enrollment, persistence and attrition, and identify systemic barriers to and supports for persistence;
- Compare and contrast these factors for all ET students, but especially for female and minority students; and,
- Develop specific recommendations for a strategic plan to improve recruitment and retention for all South Carolina ET students.

The study built upon, and was informed by, significant research in the field of enrollment and persistence of postsecondary students. At the national level, the National Center for Educational Statistics (NCES) has conducted a study of "Postsecondary Persistence and Attainment" among four-year degree and less-than-four-year degree seeking students (NCES 1995). This study found that, among students seeking two-year degrees and certificates, less than full-time attendance is negatively associated with persistence and completion. For example, while 62 percent of associate degree seekers at two-year institutions who attended full time completed an associate degree, or a higher degree, within five years, only 41 percent of those who attended half time or less completed such a degree. At the same time, for some less-than-four-year students, financial aid appears to reverse the negative association between persistence and completion and risk factors such as part-time enrollment and employment while enrolled. For example, NCES found that persistence and completion after five years among certificate seekers who received financial aid were higher than among those who did not receive such aid. Receipt of overall financial aid and receipt of grants were both found to be associated with completing associate's and higher degrees.

In South Carolina, numerous local evaluation and institutional effectiveness studies have focused on recruitment and retention. Sandi Oliver, vice president for Student Development Services at Midlands Technical College, reviewed engineering technology recruitment and retention initiatives identified in ACT 255 Institutional Effectiveness Executive Summaries (i.e., summaries of reports in response to the South Carolina legislative act designed to enhance the accountability and performance of state institutions of higher education). The summaries address local programs and studies of recruitment, retention, completion and job placement at several of the state's technical colleges from 1992 through 1996. Ms. Oliver also reviewed results of 1996 faculty interviews at seven technical colleges on factors and program strategies influencing ET student recruitment and retention. Reported challenges to improving recruitment included providing for sufficient staff and faculty time for outreach to schools and communities, competing with four-year colleges for high-quality students and encouraging adequate student preparation for ET study. Recommended retention strategies included careful monitoring of students as they progress through programs and removing artificial barriers to student advancement and completion.

Finally, review of "vitality" self-studies of institutional effectiveness at South Carolina technical colleges and descriptive analysis of State Tech system data on matriculation and duration of enrollment and graduation from 1992-97 provided further background in developing the present study.

II.   Methods

Research Design

The following set of final research questions which were used to guide the study:

- How many entering ET students are adults seeking retraining? What are their characteristics?
- What are the demographics and academic background of entering ET students?
- How many students previously enrolled in developmental studies courses enter ET programs? How many successfully complete ET programs?
- What methods are used to recruit ET students? Are any special methods used to recruit female and minority ET students?
- What are the primary instructional methods in ET programs? What are student and faculty opinions of those methods?
- What support systems are in place statewide to ensure student retention in ET programs? What are faculty, administrator, and student perceptions of them?
- What are the academic and demographic characteristics of ET graduates? Of ET dropouts?
- How do faculty and students interact in ET programs? What are each group's perceptions? Are there differences in perceptions based on gender or ethnicity?

The study focused primarily on identifying possible student-related persistence factors and faculty knowledge of, involvement in and attitudes toward student enrollment and persistence. Collected variables were grouped as follows:

a) Demographics of students entering ET programs and those who have persisted beyond the first year (assessment of first-year students shortly after matriculation and students who had persisted for at least one year);
b) Attitudes, practices and future plans that by hypothesis influence student persistence and completion; and,
c) Faculty and administrator participation in campus enrollment and retention activities, attitudes and practices that by hypothesis influence students and observations related to student attitudes and practices.

The study did not address actual persistence and completion rates or the relationship between faculty attitudes and practices and persistence and completion rates. Because student tracking data were collected, however, there is an opportunity to use data from this study to determine the relationship between persistence factors and student outcomes such as: 1) completion rate, 2) time to completion, 3) transfer to another two- or four-year institution, and 4) employment. A follow-up study may investigate the relationships between student attitudes, behaviors and future plans and these outcomes.

Design and Data Collection: In order to cover all the above research questions, data was collected from students, ET faculty and ET program administrators. Specific surveys were developed for each group, with faculty and administrators receiving the same instrument.

The study was cross-sectional (i.e., it was based on data collection at one time point for each respondent group). Because student tracking data (e.g., name and social security number) were collected, the study could be expanded at SC ATE's discretion to include annual data collections with each group in subsequent years. This would entail a longitudinal design and expansion of the data collection reported here.

The study was based on a randomized experimental design with a mixed sampling frame. The student sample was drawn randomly from 13 of the state's 16 technical colleges having ET programs. All ET Faculty and administrators were surveyed as a census (universe) sample.

Sampling Frame: The study focused on students from:
- Electronics engineering technology (EET),

- Engineering graphics (EGT),
- Mechanical engineering (MET), and
- Civil engineering (CET).

These classes were selected for two reasons. First they represented curricula offered in common across all 13 South Carolina technical colleges with engineering technology programs. Second, an objective of the study was to maximize female and minority representation in the student sample, and the EET and EGT programs are known to have strong representation from these groups. This selection criteria had the effect of "over-sampling" female and minority students, ensuring that these groups would be large enough to permit inferential analysis.

Individual students, faculty, and administrators were the unit of analysis for the study. First-year ET students were sampled from classes at the 13 technical colleges having ET program (excluding Chesterfield-Marlboro, Technical College of the Lowcountry, and Williamsburg). One class from the day and one class from the evening program were selected at each institution. The sampled classes were not of any uniform type. Selected classes at each institution were identified by knowledgeable faculty and staff. Selection criteria included having a wide distribution of student demographics and high initial enrollment. A minimum threshold of 15 students per class was set in advance; the smallest class actually sampled had 16 students.

The first-year student questionnaires were administered in courses such as:

- EGR 101 (or equivalent) and EGR 120 (or equivalent) on each of the 13 campuses (To avoid double-sampling of individuals, students in both classes were asked not complete the survey if they had already completed it. No double-sampling in fact occurred. Confidential student codes were used to keep track of students.);
- Math 175 and 178 (or equivalent) on each of the 13 campuses (using the sample procedures to prevent double-sampling);
- EGT 101 and 110 (or equivalents) on each of the 13 campuses (using the sample procedures to prevent double-sampling).

For second-year students, surveys were administered in one or two upper-level ET courses at each of the 13 campuses, depending on the number of courses offered at the institution. The vast majority of such courses were sampled, approaching a census sample. Courses were identified by the campus liaisons in consultation with other ET department faculty.

For ET faculty and administrators, a set of criteria was developed for systematic selection and inclusion in the sample. These included level of involvement in the ET program (all administrators directly involved in program management and faculty teaching full-time were sampled), experience in campus ET program (all faculty and administrators with at least three years in ET at the institution were sampled), and involvement in and knowledge of recruitment and retention initiatives at the college.

Questionnaires: The questionnaires were based on closed-ended questions in several formats, permitting detailed analysis of student responses by several key subgroups: gender, ethnicity, employment and completion of remedial training. Typical items were based on Likert-type scales measuring attitudes, knowledge and behaviors in the broad areas outlined by the research questions listed above. Specific questions were amenable to incorporation into constructed "scales" measuring broader concepts behind the research questions (e.g., student preparedness for ET course work). Each student questionnaire was designed to take about 15-20 minutes to complete. The faculty survey was slightly longer, taking about 25 minutes.

Data Collection

Questionnaires were administered in three separate phases during the fall of 1997. The first-year student survey was administered during the week of September 8-12, 1997, the third week of instruction at most colleges. Follow-up administration of the first-year student survey was

conducted at institutions not having specific courses (e.g., no evening program) until later in the year. The second-year student survey was administered during the week of October 20-24, 1997. Follow-up administration was not necessary.

The faculty and administrator survey was administered in late January 1998. Campus liaisons provided them directly to faculty, who completed them by mid-February 1998 and returned them to the campus liaisons. During the week of February 16-20, 1998, e-mail and telephone contacts were made with the campus liaisons in order to ensure a maximum response rate. A final response rate of just over 69 percent was achieved. Because of a very low item response rate for some questionnaires, the effective response rate for most dependent variables was approximately 53 percent.

Analysis

Descriptive and inferential analyses of the questionnaire data were conducted to answer the original research questions and to develop recommendations for program strategies. Descriptive analysis consisted of running the Statistical Program for the Social Sciences (SPSS) for Windows descriptive statistics procedure, resulting in means, percentages and frequency counts for all questionnaire items. Because gender and ethnicity were key student characteristics of interest, descriptive statistics by gender and ethnicity were also calculated. Each of the three respondent groups was analyzed in this way.

Also presented are results of the inferential analysis, comparing subgroups of interest (e.g., age groups, genders, ethnic groups, full-time versus part-time students, etc.) on dependent variables related directly to the research questions. The SPSS paired samples t-test procedure was used to compare subgroups. In addition, a linear regression analysis was run for selected data from the first- and second-year student questionnaires to determine the predictive value of demographic characteristics in relation to attitudes, behaviors and future plans.

III.   Results

This section presents results of the descriptive and inferential analysis. Each sub-section focuses on a specific respondent group, and begins with a table of descriptive statistics. These tables only provide those descriptive statistics relevant to the item in question (e.g., mean age is presented, but not mean number of white males). For students, a second table of descriptive statistics by gender and ethnicity is also provided.

Inferential statistics for the first- and second-year students follow. Tables show comparisons of each major subgroup on key dependent variables. Table rows highlighted in bold face represent especially noteworthy findings with respect to the research questions and SC ATE objectives that are also discussed in the narrative.

Analysis was only conducted when a minimum of 30 valid student responses per sub-group was available. Because of the low item response rate among faculty and administrators—53 percent actually completed the main body of the questionnaire form—analysis was restricted to descriptive statistics for this group.

1.   First-year students

Table III-1 presents descriptive statistics for all demographic and related independent variables.

Table III-1: First-year Descriptive Statistics				
	Mean	Percentage	Frequency (N=383)	Highest/Lowest

Table III-1: First-year Descriptive Statistics				
	Mean	Percentage	Frequency (N=383)	Highest/Lowest
Age	24.2			50/17
Gender				
Male		86%	328	
Female		14%	55	
Ethnicity				
White		73%	280	
White Male		62%	239	
White Female		11%	41	
Minority		27%	103	
Male		23%	89	71 African-American
Female		4%	14	12 African-American
Marital Status				
Unmarried		79%	301	
Married		21%	82	
Number of children	1.9			
None			284	
1 or 2			73	
More than 2			26	
Unmarried with children			N=26	
Male		69%	18	
Female		31%	8	
Remedial courses	1.07			159 Math/7 Career Planning
None		45%	173	
Some		55%	210	
Major Field Chosen				
No		3%	12	
Yes		97%	371	
Employment in Field Related to Major				
Unemployed		45%	173	
Employed in unrelated field		35%	134	
Employed in related field		20%	76	
Evening courses				
None		68%	262	
Some		18%	69	
All		14%	52	
Distance traveled each way to college				
Less than 6 miles		20%	76	
6-10 miles		18%	69	
11-20 miles		26%	99	
More than 20 miles		36%	139	
Taken course in ET prior to this semester				
No		69%	264	
Yes		31%	119	

Because increasing the diversity of ET students and graduates is a major goal of the SC ATE Center of Excellence, a separate descriptive analysis of first-year students by gender and ethnic categories was conducted. **Table III-2** presents the results.

Table III-2: First-year Descriptive Statistics by Gender and Ethnicity				
Descriptive Statistics (N=378)	White Male (N=238)	White Female (N=41)	Minority Male (N=85)	Minority Female (N=14)
Major field				
None	7	0	2	1
EET	89	6	46	5
EGT	48	20	13	4
MET	29	4	7	0
CET	24	5	5	1
Other	41	6	12	3
Current Academic Objective	(2 missing)			
Just take courses	3	1	1	0
Obtain ET certificate	16	1	4	0
Obtain other certificate	3	0	0	1
Earn 2-year ET degree	169	32	57	12
Earn other 2-year degree	7	1	3	0
Transfer to another 2-year	2	0	2	0
Transfer to a 4-year	36	6	18	1
Preferred Type of Instruction	(1 missing)		(1 missing)	
Lecture	6	2	3	2
Discussion	14	1	7	1
Applied or "hands-on" projects	134	18	37	5
Team with 1 other student	5	0	1	1
Team with multiple students	11	2	6	0
All above equal	67	18	30	5
Main motivation for studying ET	(1 missing)		(1 missing)	
Family or friends	15	1	4	0
Instructor or counselor	1	2	1	1
Personal enrichment	84	11	30	4
Lack of other opportunities	10	3	2	0
Get new or better job in ET	46	9	16	5
Get new or better job in another field	14	3	5	1
Earn more money	53	7	26	3
Other	14	5	0	0
If you have chosen an ET major, why did you choose it	(3 missing)		(1 missing)	(1 missing)
No ET major yet	14	4	4	1
Instructor or counselor	1	2	1	1
Friend or relative	9	2	5	0
Job opportunities	51	7	22	3
Personal skills	44	7	8	0
Personal interest	106	18	38	6
College is strong in my major	4	1	5	1
Other	6	0	1	1

First-year Student Inferential Analysis: First-year students are compared on the basis of the following subgroups:

- Age (traditional age v. non-traditional)
- Gender
- Ethnicity (minority grouped together because of sample size)
- Marital status (single, separated and divorced were combined)
- Number of children
- Remedial courses taken
- Prior ET study (before the student enrolled in his or her current program)

Table III-3 displays statistically significant differences between first-year students of "traditional," college-going age (17-24) and older, "non-traditional" age students (25 and older). Several key factors influence younger students' attitudes more than they do older students' attitudes. Perceived difficulty, which is clearly related to high school preparation among first-year students, is a greater factor in first-year students' choosing not to enroll (43% of traditional to 31% of non-traditional age students). Perception of instructor is a much greater factor in deciding to stay in an ET course for traditional students (69% to 52%). Knowing other students is both a major factor in choosing an ET course and in deciding to remain in a course, although percentages for both groups are relatively low (16% to 7% and 18% to 6%, respectively).

Table III-3: First-year students by age group				
	"Traditional" age (N=261)		"Non-traditional" age (N=122)	
	Mean	Percentage	Mean	Percentage
Difficulty of ET programs is a major reason students choose not to enroll[*]		**43%**		**31%**
Lack of awareness of ET program benefits is a major reason students choose not to enroll[*]		31%		44%
Relationship with instructor[1]	3.88		3.67	
Instructor is a major factor in deciding to stay in an ET course[3]	**1.69**	**69%**	**1.52**	**52%**
Knowing other students in the course is a major factor in choosing an ET course[2]	**1.16**	**16%**	**1.07**	**7%**
Knowing other students in the course in a major factor in deciding to stay in an ET course[2]	**1.18**	**18%**	**1.06**	**6%**
ET courses at my college satisfy my educational needs[1]	3.88		4.07	

Difficulty of ET programs is a major reason students choose not to enroll*
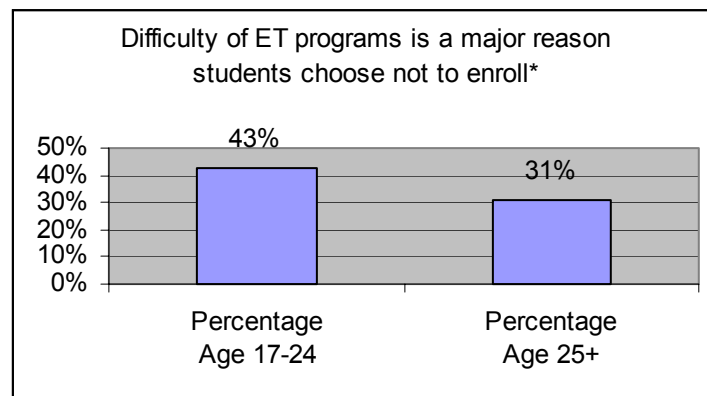
Table III-4 compares first-year students by gender. Substantially more female than male students feel that perception of instructor is a major factor in deciding to stay in an ET course (76% to 61%). Although levels of agreement for both groups were low, male students were more likely than females to indicate knowing students in an ET course was a major factor in deciding to stay in the course (16% to 5%).

Table III-4: First-year students by gender				
	Male (N = 328)		Female (N = 55)	
	Mean	Percentage	Mean	Percentage
Belief that ET does not help you get a better job is major reason students choose not to enroll[*]		2%		0%
Expense of ET is a major reason students choose not to enroll[^]		9%		2%
Instructor is a major factor in deciding to stay in an ET course[2]	**1.61**	**61%**	**1.76**	**76%**
Knowing other students in the course is a major factor in deciding to stay in an ET course[2]	1.16	16%	1.05	5%

Instructor is a major factor in deciding to stay in an ET course2
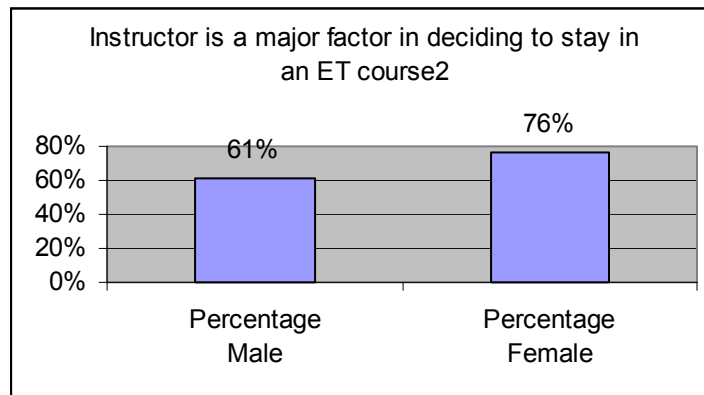
Table III-5 compares first-year students based on ethnicity. Because most of the collected ethnic sub-samples are too small to conduct meaningful inferential analysis, all minority students are combined into one category for comparison purposes.

Numerous differences were found between first-year students based on ethnicity. More white students than minority students reported lack of awareness of ET program benefits as a major reason students choose not to enroll (39% to 26%). Subject matter was a greater factor both in choosing an ET course and in deciding to stay in it for white students than for minority students (86% to 68% and 78% to 53%, respectively). More white students than minority students reported that the belief that an ET course would help them get a new or better job was a major factor in deciding whether to take it (92% to 75%). Encouragement from an employer was great factor for white students than for minority students both in choosing an ET course and in deciding to stay in it (56% to 37% and 53% to 36%). Finally, the decision to continue studying ET was more dependent on receiving 1) student services and 2) financial aid for minority students than for white students (mean responses of 3.35 to 2.77 and 3.47 to 2.70, respectively).

Table III-5: First-year students by ethnicity

	Minority (N = 103)		White or Caucasian (N = 280)	
	Mean	Percentage	Mean	Percentage
Lack of awareness of ET program benefits is a major reason students choose not to enroll[*]		**26%**		**39%**
Subject matter is a major factor in choosing an ET course[3]	**1.68**	**68%**	**1.86**	**86%**
Subject matter is a major factor in deciding to stay in an ET course[3]	**1.53**	**53%**	**1.78**	**78%**
Time course is offered is a major factor in deciding to stay in an ET course[3]	1.43	43%	1.64	64%
Course will help you get a new or better job is a major factor in choosing to take an ET course[3]	**1.75**	**75%**	**1.92**	**92%**
Encouragement from employer is a major factor in choosing to take an ET course[3]	**1.37**	**37%**	**1.56**	**56%**
Encouragement from employer is a major factor in deciding to stay in an ET course[2]	**1.36**	**36%**	**1.53**	**53%**
College offers courses at convenient times[4]	3.43		3.76	
Decision to continue studying ET depends on receiving student services[4]	**3.35**		**2.77**	
Decision to continue studying ET depends on receiving financial aid[4]	**3.47**		**2.70**	
Plan to continue taking classes in another field over next year[*]	1.00	0%	1.14	14%
Plan to get a new job in another field over next year[*]	1.00	0%	1.08	8%

Need for Financial Aid and Student Services by Ethnicity

Legend:
- Decision to continue studying ET depends on receiving student services4
- Decision to continue studying ET depends on receiving financial aid4
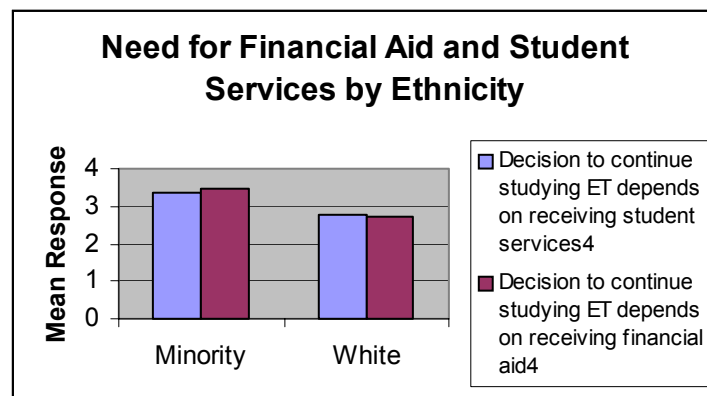
Table III-6 compares first-year students by marital status. For purposes of this analysis, all single, separated and divorced students were grouped together and compared to students who reported themselves as currently married.

More unmarried students than married students reported the perceived difficulty of ET programs is a major reason students choose not to enroll in them. More married than unmarried students reported that lack of awareness of ET program benefits is a major reason students choose not to enroll in them.

Table III-6: First-year students by Marital Status				
	Unmarried (N = 301)		Married (N = 82)	
	Mean	Percentage	Mean	Percentage
Difficulty of ET programs is a major reason students choose not to enroll[^]		**44%**		**21%**
Lack of awareness of ET program benefits is a major reason students choose not to enroll[^]		**31%**		**52%**
Relationship with instructor[1]	3.68		3.93	
Instructor is a major factor in deciding to stay in an ET course[*]	1.67	67%	1.50	50%
Knowing other students taking course is a major factor in deciding to stay in an ET course[*]	1.17	17%	1.06	6%
College offers courses at convenient times[1]	3.72		3.50	
Plan to transfer to another 2-year college in next year[*]	1.00	0%	1.05	5%

Reasons Students Choose Not to Enroll in ET by Marital Status
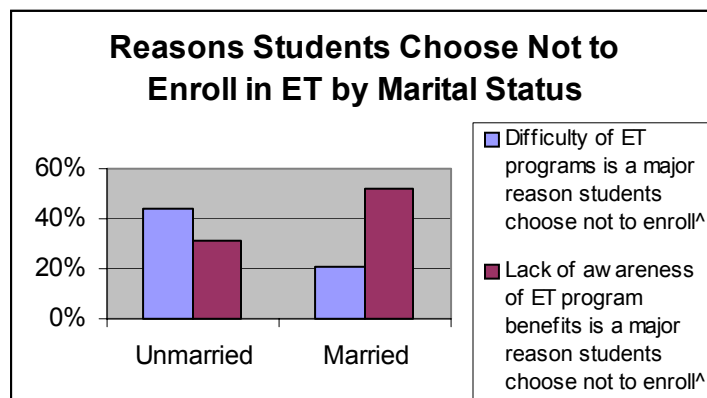
Table III-7 presents findings on students who reported having no children in comparison to those who reported having at least one child. For students with children, importance of their relationship with instructors is a much greater factor in deciding whether to continue studying ET than for students without children (mean 4.04 to 3.62). Encouragement from instructor to attend is a much greater factor in choosing an ET course for students with children than for those without (53% to 34%). Although percentages were very low for both groups, more students with children reported planning to transfer to another two-year college in the next year than did students without children.
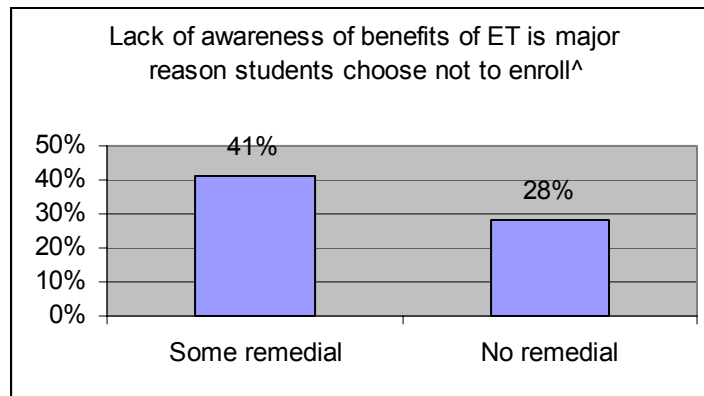
Table III-7: First-year students by Number of Children				
	No children (N = 285)		Children (N = 98)	
	Mean	Percentage	Mean	Percentage
Difficulty of ET programs is a major reason students choose not to enroll[*]		42%		31%
Importance of relationship with instructors in deciding whether to continue studying ET[4]	**3.62**		**4.04**	
Encouragement from instructor to attend is a major factor in choosing ET course[3]	**1.34**	**34%**	**1.53**	**53%**
Encouragement from instructor to attend is a major factor in deciding to stay in an ET course[2]	1.41	41%	1.56	56%
Decision to continue studying ET depends on receiving financial aid[1]	2.79		3.24	
Plan to continue taking classes in ET over next year[3]	1.89		1.97	
Plan to transfer to another 2-year college over next year[3]	**1.00**	**0%**	**1.04**	**4%**

Importance of relationship with instructors in deciding whether to continue studying ET4
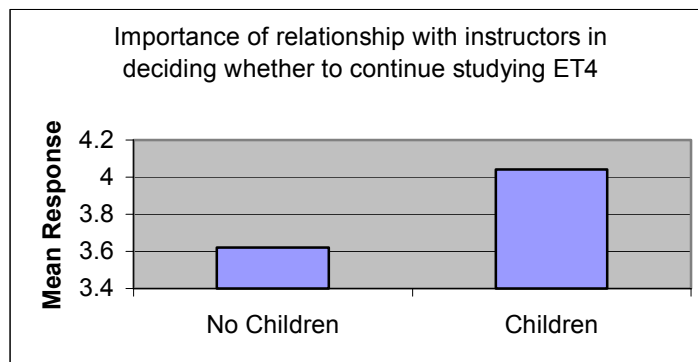
   Table III-8 shows differences between students who reported taking at least one remedial course (as defined in the questionnaire) and students who reported never taking such a course. Students who had taken remedial courses, more often than students who had not, indicated that lack of awareness of ET program benefits (41% to 28%), and the length of time it takes to complete an ET program (18% to 9%) are major reasons students like them choose not to enroll.

| Table III-8: First-year students by Remedial Courses				
	Some remedial courses (N = 210)		No remedial courses (N = 173)	
	Mean	Percentage	Mean	Percentage
Not enough preparation in high school is major reason students choose not to enroll[*]		43%		33%
Lack of awareness of benefits of ET is major reason students choose not to enroll[^]		**41%**		**28%**

Table III-8: First-year students by Remedial Courses				
	Some remedial courses (N = 210)		No remedial courses (N = 173)	
	Mean	Percentage	Mean	Percentage
Takes too long to complete an ET degree or certificate[^]		**18%**		**9%**
Do not need an ET degree or certificate[*]		6%		13%
Course will help you get a new or better job is a major factor in choosing to take an ET course[2]	1.79	79%	1.90	90%
Quality of facilities and resources[1]	3.83		3.63	
Decision to continue studying ET depends on receiving student services[1]	3.06		2.76	

Lack of awareness of benefits of ET is major reason students choose not to enroll^

(Some remedial: 41%; No remedial: 28%)

Table III-9 compares first-year students by prior study in ET. Students who had some prior ET study reported feeling better prepared to succeed in ET than students who had no prior study (mean 3.89 to 3.56).

Table III-9: First-year students by Prior ET Study				
	No Prior ET Study (N = 264)		Some Prior ET Study (N = 119)	
	Mean	Percentage	Mean	Percentage
Feel well prepared to succeed in ET[4]	**3.56**		**3.89**	
Plan to continue taking classes in ET over next year[2]	1.89	89%	1.96	96%

Feel well prepared to succeed in ET4
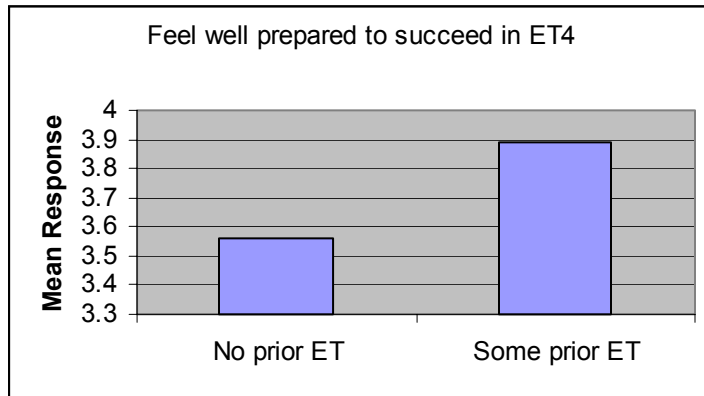
2.   Second-year students

Table III-10 presents descriptive statistics for all demographic and related independent variables.

Table III-10: Second-year Descriptive Statistics				
	Mean	Percentage	Frequency (N=196)	Highest
Age	25.5			50
Gender				
Male		85%	166	
Female		15%	30	
Ethnicity				
White Male		66%	129	
White Female		10%	20	
Minority Male		19%	37	31 African American
Minority Female		5%	10	9 African American
Marital Status				
Unmarried		70%	137	
Married		30%	59	
Number of children				
None		71%	139	
1 or 2		24%	47	
More than 2		5%	10	
Remedial courses				
None		33%	64	
Some		67%	132	
Number of semesters at current college				
Courses per semester	3.52			
Evening courses				
None		70%	137	
Some		22%	44	
All		8%	15	
Completed 2-year degree		6%	11	
Completed 4-year degree		3%	5	
Distance traveled each way to college				

Table III-10: Second-year Descriptive Statistics				
	Mean	Percentage	Frequency (N=196)	Highest
Less than 6 miles		15%	30	
6-10 miles		18%	35	
11-20 miles		24%	46	
More than 20 miles		43%	84	

As in the case of first-year students, we conducted a separate descriptive analysis of second-year students by gender and ethnic categories. **Table III-11** presents the results.

| Table III:11 Second-year Descriptive Statistics by Gender and Ethnicity				
Descriptive Statistics (N=196)	White Male (N =129)	White Female (N=20)	Minority Male (N=37)	Minority Female (N=10)
Major field				
None	0	0	1	0
EET	55	5	22	5
EGT	21	7	2	4
MET	12	3	7	0
CET	22	1	1	1
Other	19	4	4	0
If you have chosen an ET major, why did you choose it	(1 missing)			
Teacher or counselor	6	1	1	0
Friend or relative	14	2	2	2
Job opportunities	33	2	12	3
Personal skills fit the field	17	2	6	0
Personal interest	52	11	15	4
My college is strong in the field	1	1	0	1
Other	5	1	1	0
Current Academic Objective				
Just take courses	2	0	3	0
Obtain ET certificate	4	1	6	1
Obtain other certificate	14	1	6	2
Earn 2-year ET degree	12	0	3	0
Earn other 2-year degree	2	1	2	0
Transfer to another 2-year	3	0	5	1
Transfer to a 4-year	107	18	29	7
Who pays for majority of educational expenses	(1 missing)			
Self	33	2	13	1
Employer	23	2	3	1
Family or friends	32	1	1	2
Grant or scholarship	19	9	16	3
Loans	3	3	0	1
Other	18	3	4	2
Would you relocate to another part of the state for…				
ET job	93	12	32	8
Job in another field	10	2	3	2
Continue ET education	41	4	14	4
Continue education in another field	5	1	2	0
Other	21	3	2	0

Table III-12 points out differences between second-year traditional age and non-traditional age students, using the same group definitions as for first-year students. For traditional age students, encouragement from family or friends was more often their current and original motivation to study ET than for older students (8% to 1% and 19% to 9%, respectively). While these differences between age groups are both significant (p < .01), it is important to note that there is also a significant drop (19% to 8%, p < .01) in family and friends as the main source of motivation for the 17-24 year-old students between the first and second years of ET study.

Table III-12: Second-year students by age group				
	"Traditional age" (N = 116)		"Non-traditional age" (N = 80)	
	Mean	Percentage	Mean	Percentage
Main educational objective 1 year ago was to earn a 2-year degree at this college[*]		60%		74%
Main motivation to study ET now is encouragement from family or friends[*]		**8%**		**1%**
Main motivation to study ET 1 year ago was encouragement from family or friends[*]		**19%**		**9%**
Main motivation to study ET now is personal enrichment[*]		**36%**		**20%**
Main motivation to study ET 1 year ago was getting a new or better job in another field[^]		7%		21%
Encouraged to study ET by classes using teamwork and group learning[1]	2.75		2.28	

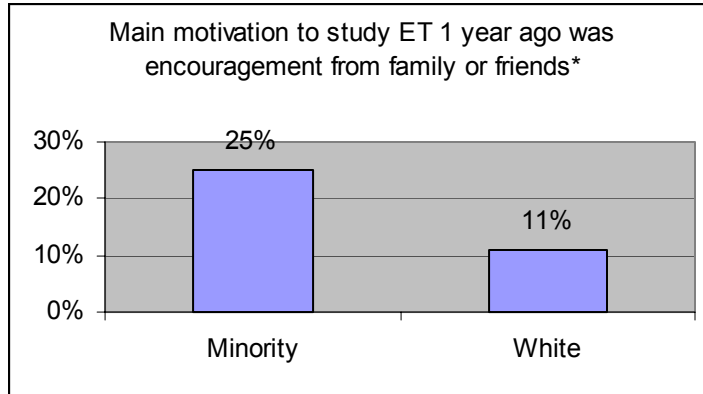Main motivation to study ET now is personal enrichment*
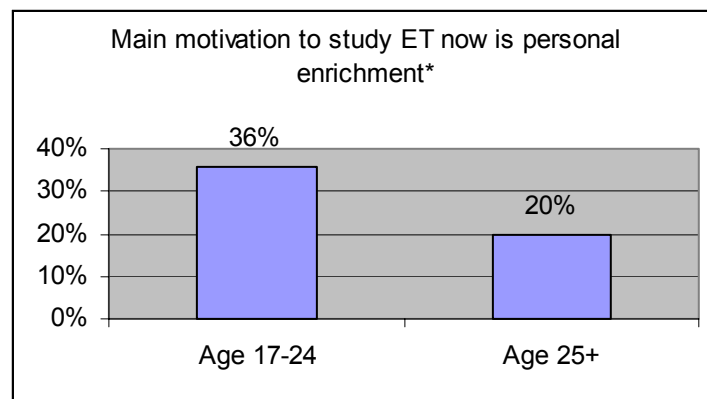
Table III-13 displays statistically significant differences between second-year male and female students. More female students than male reported their original educational objective was to earn an ET degree at their current college (80% to 63%). At the same time, more male students than female reported lack of job opportunity in their field is their current motivation to study ET (7% to 0%). Knowing other students taking an ET course was a much great reason to take that course for male students than for females (21% to 0%). Finally, more female than male students felt their college offered courses at convenient times (mean 3.97 to 3.55).

Table III-13: Second-year students by gender				
	Male (N = 166)		Female (N = 30)	
	Mean	Percentage	Mean	Percentage
Main educational objective now is take courses but not pursue a degree or certificate[*]		3%		0%
Main educational objective 1 year ago was to earn an ET degree at this college[*]		63%		80%
Main educational objective 1 year ago was to earn a degree in another field at this college[*]		3%		0%
Main educational objective 1 year ago was to transfer to another 2-year college[*]		5%		0%
Main motivation to study ET now is encouragement from instructor or counselor[*]		4%		0%
Main motivation to study ET now is lack of opportunity in current job or field of study[^]		**7%**		**0%**
Encouraged to study ET by a work environment based on teamwork and group learning[1]	2.71		1.93	
Subject matter is a major factor in deciding to stay in a course[2]	1.64	64%	1.30	30%
Instructor encouragement is a major factor in choosing a course[2]	1.30	30%	1.03	3%
Instructor encouragement is a major factor in deciding to stay in a course[2]	1.39	39%	1.07	7%
Encouragement from family or friends is a major factor in choosing a course[2]	1.26	26%	1.00	0%
Knowing other students taking course is a major factor in choosing a course[3]	**1.21**	**21%**	**1.00**	**0%**
College offers courses at convenient times[4]	**3.55**		**3.97**	
Hours per week worked since you began studying ET[1]	4.31 (avg. 21-30 hours)		3.53 (avg. 11-20 hours)	

Main educational objective 1 year ago was to earn an ET degree at this college*
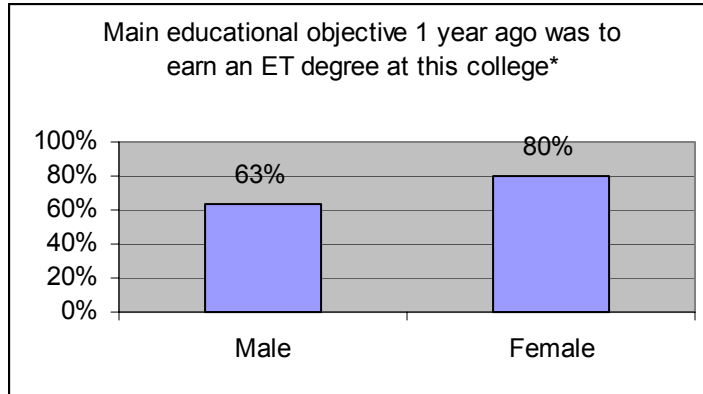
Table III-14 presents comparisons of second-year students by ethnicity. More minority than white students reported their original main educational objective was to take courses but not pursue a degree and to obtain a certificate in another field (15% to 3% and 12% to 2%, respectively). When they began their studies, minority students also were more often motivated to study ET because of encouragement by family or friends and because of a desire for personal enrichment (25% to 11% and 45% to 27%, respectively).

Table 14: Second-year students by ethnicity[5]				
	Minority (N = 47)		White or Caucasian (N = 149)	
	Mean	Percentage	Mean	Percentage
Main educational objective 1 year ago was to take courses but not pursue a degree or certificate[*]		**15%**		**3%**
Main educational objective 1 year ago was to obtain a certificate in another field at this college[*]		**12%**		**2%**
Main motivation to study ET 1 year ago was encouragement from family or friends[*]		**25%**		**11%**
Main motivation to study ET 1 year ago was personal enrichment[*]		**45%**		**27%**
Main motivation to study ET now is to get a new or better ET job[*]		51%		34%
Encouraged to study ET by classes using teamwork and group learning[1]	3.09		2.39	
Feel that ET courses satisfy personal educational needs[1]	4.13		3.84	
Employed in a field directly related to ET major[6]	2.32		2.76	
Plan to continue taking ET courses over next year[2]	1.64		1.87	

Main motivation to study ET 1 year ago was encouragement from family or friends*

	Minority	White
Percentage	25%	11%

(Bar chart: Minority = 25%, White = 11%. Y-axis scale 0% to 30%)

Table III-15 compares second-year students by marital status. Unmarried students were grouped as in the first-year student analysis.

A much higher percentage of married students than unmarried reported that earning an ET degree at their current college was their original educational objective (81% to 59%). Although percentages were low, more unmarried than married students indicated they were motivated to study ET by encouragement from family or friends. Knowing other students taking an ET course was a greater factor in deciding to stay in the course for unmarried students than married students.

| Table III-15: Second-year students by Marital Status[7]				
	Unmarried (N = 127)		Married (N = 69)	
	Mean	Percentage	Mean	Percentage
Main educational objective now is to take courses but not pursue a degree or certificate*		4%		0%
Main educational objective 1 year ago was to earn an ET degree at this college^		**59%**		**81%**
Main educational objective now is to earn a degree in another field at this college^		**7%**		**0%**
Main motivation to study ET is encouragement from family or friends^		**7%**		**0%**
Main motivation to study ET is encouragement from an instructor or counselor*		4%		0%
Encouraged to study ET by a positive role model[1]	2.91		2.38	
Encouraged to study ET by a work environment based on teamwork and group learning[1]	2.76		2.17	
Encouragement from instructor is major factor in choosing ET course[2]	1.34	34%	1.12	12%
Encouragement from family or friends is a major factor in deciding to stay in an ET course[2]	1.31	31%	1.10	10%
Knowing other students taking course is a major factor in	1.23	23%	1.04	4%

Table III-15: Second-year students by Marital Status[7]				
	Unmarried (N = 127)		Married (N = 69)	
	Mean	Percentage	Mean	Percentage
choosing a course[2]				
Knowing other students taking course is a major factor in deciding to stay in a course[3]	**1.25**	**25%**	**1.01**	**1%**

Knowing other students taking course is a major factor in deciding to stay in a course3
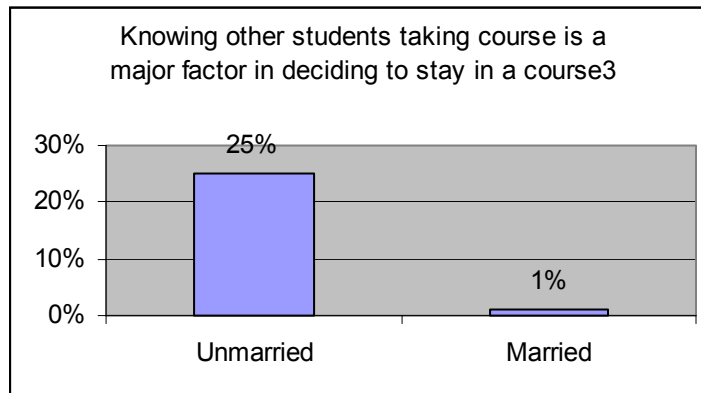
Table III-16 presents comparisons between second-year students with and without children. Several differences were found. No students with children reported earning a two-year degree in another field at their current college was their current educational objective, while six percent of students without children said it was. More students without children said encouragement from family or friends and earning more money was their current motivation to study ET (7% to 0% and 22% to 7%, respectively). More students without children said their original motivation to study ET was encouragement from family or friends (19% to 5%). Note that the drop from 19% to 7% in motivation from family or friend encouragement among students without children is also significant ($p < .05$). Finally, far more students without children than those with children reported knowing other students taking an ET course was a major factor in deciding to take it (26% to 0%).

Table III-16: Second-year students by Number of Children				
	No children (N=139)		Children (N=57)	
	Mean	Percentage	Mean	Percentage
Main educational objective 1 year ago was to take courses but not pursue a degree or certificate[*]		8%		2%
Main educational objective 1 year ago was to earn an ET degree at this college[*]		61%		77%
Main educational objective now is to earn a 2-year degree in another field at this college[^]		**6%**		**0%**
Main motivation for study ET now is encouragement from family or friends[^]		**7%**		**0%**
Main motivation to study ET 1 year ago was encouragement from family or friends[^]		**19%**		**5%**
Main motivation to study ET now		4%		0%

Table III-16: Second-year students by Number of Children				
	No children (N=139)		Children (N=57)	
	Mean	Percentage	Mean	Percentage
is encouragement from an instructor or counselor[*]				
Main motivation to study ET now is to earn more money in future[^]		**22%**		**7%**
Encouraged to study ET by classes in school based on teamwork and group learning[1]	2.71		2.18	
Encouragement by family or friends is a major factor in choosing to stay in an ET course[2]	1.30	30%	1.09	9%
Knowing other students taking course is a major factor in choosing to take an ET course[2]	1.22	22%	1.02	2%
Knowing other students taking course is a major factor in deciding to stay in an ET course[3]	**1.26**	**26%**	**1.00**	**0%**
Encouragement by employer to take course is a major factor in deciding to take an ET course[2]	1.46	46%	1.19	19%
Employed in a field related to ET major[6]	2.77		2.37	
Hours per week worked since you began studying ET[1]	4.45 (30+)		3.60 (21-30)	

Knowing other students taking course is a major factor in deciding to stay in an ET course3
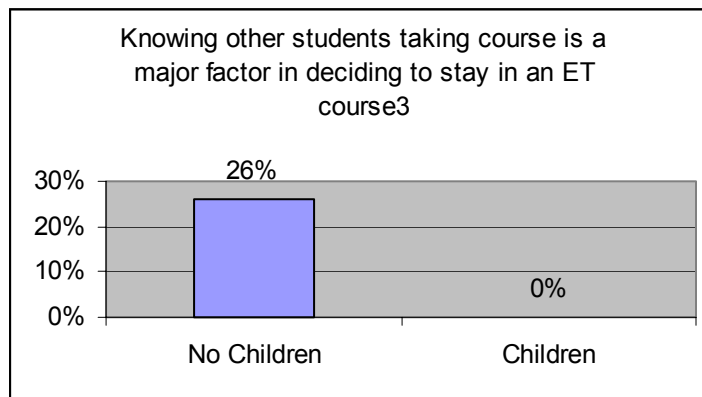
Table III-17 compares students who reported having taken at least one remedial course to those who reported having taken none. Although both percentages were high, more students who had taken a remedial course reported they planned to continue taking ET courses over the next year than those who had not (86% to 70%).

Table III-17: Second-year students by Remedial Courses				
	Some remedial courses (N = 132)		No remedial courses (N = 64)	
	Mean	Percentage	Mean	Percentage
Main educational objective is to		4%		0%

Table III-17: Second-year students by Remedial Courses				
	Some remedial courses (N = 132)		No remedial courses (N = 64)	
	Mean	Percentage	Mean	Percentage
obtain a certificate in another field at this college[*]				
Relationship to instructor[1]	4.11		3.77	
Plan to continue taking ET courses over next year[2]	1.86	86%	1.70	70%

Table III-18 presents results of comparisons between students who are enrolled full time and those who are enrolled part time. Far more part-time than full-time students reported their original motivation to study ET was to get a new or better ET job (42% to 20%). On the other hand, far more full-time than part-time students said their main motivation now was to get a new or better job in another field (16% to 4%).

Table III-18: Second-year students by Full-time Enrollment Status[8]				
	Enrolled part-time (N = 69)		Enrolled full-time (N = 127)	
	Mean	Percentage	Mean	Percentage
Main motivation to study ET now is encouragement from family or friends[*]		1%		7%
Main motivation to study ET 1 year ago was to get a new or better ET job[^]		**42%**		**20%**
Main motivation to study ET now is to get a new or better job in another field[^]		**4%**		**16%**
College offers adequate student support services[1]	3.29		3.63	
Employed in a field related to ET major[6]	2.97		2.48	

Main motivation to study ET 1 year ago was to
get a new or better ET job^

Part-time: 20%   Full-time: 42%
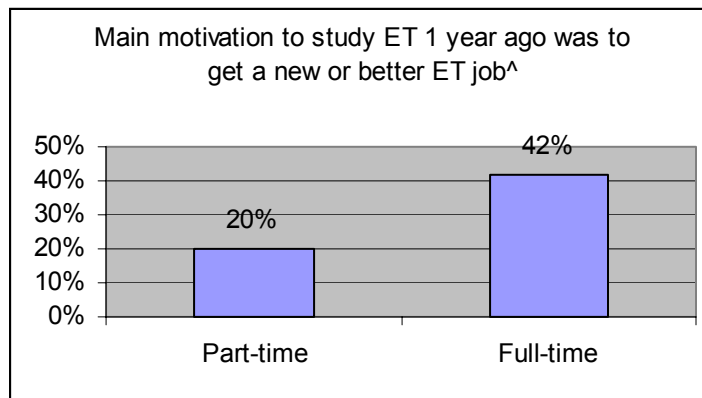
Table III-19 compares students who are employed full time to those who are employed part time. Unemployed students were excluded from the analysis. Far more students employed full time than part time reported relationship to their instructor was a major factor in continuing to study ET (mean 4.24 to 3.88). Far more full-time than part-time employed students said subject

matter was a major factor both in choosing to take an ET course and in deciding to stay in it (90% to 62% and 78% to 50%, respectively).

Table III-19: Second-year students by Full-time Employment Status[9]				
	Employed part-time (N = 69)		Employed full-time (N = 127)	
	Mean	Percentage	Mean	Percentage
Main educational objective now is to take courses but not pursue a degree or certificate[*]		4%		0%
Main educational objective now is to obtain a certificate in another field at this college[*]		4%		0%
Main educational objective now is to earn a 2-year degree in another field at this college[*]		7%		0%
Encouraged to study ET by strong support at home[1]	3.55		3.00	
Relationship to instructor[4]	**3.88**		**4.24**	
Subject matter is a major factor in choosing to take an ET course[3]	**1.62**	**62%**	**1.90**	**90%**
Subject matter is a major factor in deciding to stay in an ET course[3]	**1.50**	**50%**	**1.78**	**78%**
Encouragement by instructor is a major factor in deciding to stay in an ET course[2]	1.28	28%	1.46	46%
Coursework in ET is relevant to current job[1]	1.96		2.87	
Employer is providing monetary reward for finishing ET program[2]	1.00	0%	1.13	13%
Plan to get a new job in a field other than ET[2]	1.00	0%	1.12	12%

How Strong is Your Relationship With Your Instructor?4
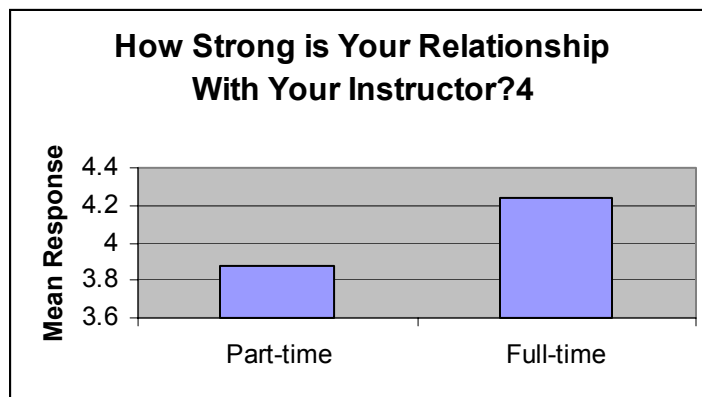
First- and Second-year Student Comparisons

First- and second-year student data were compared in order to determine how ET students who have completed at least one year of study, and therefore have cleared the initial "hurdle"

courses and other educational and occupational obstacles to degree completion, differ from beginning students. Since the two samples are independent, independent samples t-tests were conducted for the inferential analysis. The purpose of these analyses was to identify factors that predict persistence among students who have completed at least one year of ET study. Comparisons were made on the basis of specific questionnaire items collected in common between the two groups.

The following significant differences were observed between first- and second-year groups:

- Sixty-seven percent of second-year students had taken at least some remedial courses, as compared to only 55 percent of first-year students ($p < .01$);
- Thirty percent of second-year students were married, as compared to only 21 percent of first-year students ($p < .05$);
- Sixty-nine percent of second-year students were employed, as compared to 55 percent of first-year students ($p < .01$);
- Among students who were both employed and had chosen a major, 42 percent of second-year students were employed in field related to their major compared to only 35 percent of first-year students ($p < .05$);
- Forty-three percent of second-year students traveled at least 20 miles each way to college, while only 36% of first-year students traveled that far ($p < .05$);
- Among students who had declared a major, relative numbers of EET and EGT majors flip-flopped between the first- and second-year students—45 percent of second-year compared to only 39% of first-year students were EET majors while only 17 percent of second-year compared to 23 percent of first-year students were EGT majors (both $p < .05$);
- Thirty-eight percent of second-year students, as compared to only 20 percent of first-year students, reported "getting a new or better job in ET" as their main reason for studying for an ET degree ($p < .01$); roughly equal numbers first-year students and second-year students thinking back to their first year experience, reported "personal enrichment" as their primary motivation (32 percent and 30 percent, respectively);
- Seventy-two percent of second-year students reported having a "very good" or excellent relationship with their instructors, compared to only 58 percent of first-year students ($p < .01$);
- Forty-two percent of second-year students reported "having the skills necessary to succeed" was their main reason for choosing their ET major, as compared to only 22 percent of first-year students ($p < .01$);
- Sixty-two percent of first-year students compared to 54 percent of second-year students rated the quality of their college's facilities and ET resources "high" or better ($p < .05$);
- Sixty-two percent of first-year students compared with 53 percent of second-year students rated student services for ET "very good" or better ($p < .05$);
- Fifty-one percent of first-year students compared with only 41 percent of second-year students reported learning best with instruction using "applied or hands-on" projects ($p < .05$); forty-two percent of second-year students had no preference of instructional methods, compared to only 31 percent of first-year students ($p < .05$).

Faculty and Administrators

The "Survey of Engineering Technology Faculty and Administrators" was conducted to learn about ET faculty and staff involvement in recruitment and retention programs, third-party opinions of factors affecting students and ideas for future program interventions. Unfortunately, the survey achieved a low item response rate of only 53 percent, making inferential analysis

problematic. As a result, we decided to treat this component of the study as a pilot and to conduct only descriptive analysis of the data.

Table III-20 provides a summary of faculty and administrator descriptive statistics.

Table III-20: Faculty and Administrator Demographics				
	Mean	Percentage	Frequency (N=91)	Highest
Gender				
Male		73%	66	
Female		27%	25	
Years at current inst.	10.73			28
Total years teaching exp.	15.28			35
Position				
Adjunct		1%	1	
Full-time faculty		51%	46	
Coordinator		12%	11	
Department head		24%	22	
Program Director		2%	2	
Dean		9%	8	
Other		1%	1	
Average Credit Hours Taught				
Fewer than 15 (part-time)		57%	52	
15 or more (full-time)		43%	39	
Involvement in ET			**N=70**	
Teach only		21%	15	
Mostly teach, some admin.		59%	41	
Mostly admin., some teach		11%	8	
Admin. only		6%	4	
Other		3%	2	
Main Area of ET taught			**N=70** (some faculty recorded more than one response)	
None		13%	9	
EET		34%	24	
EGT		30%	21	
MET		23%	16	
CET		17%	12	
Other		33%	23	
Percentage of classes participating in student surveys		36% (41% unsure)	**N=70** 25 (29 unsure)	
SC ATE project participation		49%	**N=70** 34	

Table III-21: Faculty and Administrator Activities, Perceptions and Issues			
	Mean	Percentage	Frequency (N=91)
Involvement in college recruitment programs	3.97 ("quite a bit")		N=67 (had some involvement)
Involvement in college retention programs	3.95 ("quite a bit")		N=65

Table III-21: Faculty and Administrator Activities, Perceptions and Issues			
	Mean	Percentage	Frequency (N=91)
Involvement in college recruitment programs with local high schools	3.07 ("somewhat")		N=67
Involvement in college youth apprenticeship programs for ET with local industries			N=89
Auto			37
Textile			7
Information Technology			9
Machine shop			8
Commercial graphics			8
Professional			10
Government			9
Other			1
Types of support from local industry for student retention			N=70
Internships		17%	12
Faculty mentoring		27%	19
Degree incentive		53%	37
Better selectivity		79%	55
Better evaluation		36%	25
Better preparation in high school		23%	16
Learning environment		66%	46
Job-relevant skills		9%	6
In-plant laboratories		10%	7
Effect of current work experience on persistence	3.91 ("quite a bit")		N=69
Effect of past work experience on persistence	3.77 ("quite a bit")		N=68
Estimate of percentage of students at college sufficiently well-prepared	4.94 (in the 41-50% range)		N=70
Most important reason for lack of preparedness: <u>Lack of technology background</u>		67%	47 (N=70)
Most important factors in ET student persistence: <u>Quality of instruction/academic preparation</u>		22%/22%	15/15 (N=69)
Most important factor in ET student drop out: <u>Academic preparation</u>		67%	47 (N=70)
Importance of gender for ET student persistence	1.92 ("not very important")		
Importance of ethnicity for ET student persistence	1.88 ("not very important")		
Most important reason gender is a factor in student persistence: <u>Student attitudes or behavior</u>		16%	11 (N=69)
Most important reason ethnicity is a factor in student persistence: <u>Student attitudes or behavior</u>		22%	15 (N=69)

Table III-21: Faculty and Administrator Activities, Perceptions and Issues			
	Mean	Percentage	Frequency (N=91)
Three most effective methods of increasing recruitment			(Respondents were asked to choose one; no one response was significantly higher)
Plant tours and presentations	3.38 ("somewhat effective")		
ET faculty presentations at high schools	3.32 ("somewhat effective")		
Co-op education programs for high school students	3.31 ("somewhat effective")		
Three most effective methods of increasing retention			(Respondents were asked to choose one; no one response was significantly higher)
Job shadowing programs	3.68 ("very effective")		
Apprenticeships	3.53 ("somewhat/ very effective")		
Summer ET workshops	3.49 ("somewhat/ very effective")		
Greatest challenge to technical colleges seeking to improve recruitment and retention: <u>Lack of student, parent, & community awareness of ET program benefits</u>		83%	57 (N=69)
Greatest challenge to faculty & administrators seeking to improve recruitment and retention: <u>High teaching loads</u>		70%	48 (N=69)
Three most beneficial recruitment programs SC ATE Center could undertake			(Respondents were asked to choose 3 responses
ET preparation courses for high school students		35%	24 (N=69)
ET faculty presentations at high schools		30%	21
Summer ET workshops for high school students		30%	21
Four most beneficial retention programs SC ATE Center could undertake			(Respondents were asked to choose 3 responses
Enhanced student support services such as tutoring and study skills training		51%	35 (N=69)
Internships		26%	18
Co-op education programs		26%	18
Increase use of instructional technology		26%	18

Discussion

The data presented in Section III present a complex picture of student and faculty attitudes and practices related to enrollment, persistence, completion and future employment in engineering technology. The following points represent large-scale findings that emerge from the data, cross-cut subgroups and questionnaire content areas, and provide at least partial answers to the original research questions.

Relationship between results and research questions. This section reviews the original research questions in relation to the descriptive and inferential findings.

How many entering ET students are adults seeking retraining? What are their characteristics? Among first-year students, 32 percent were of non-traditional age (25 and older) and were returning to school after having been in society and the workforce. Forty-one percent of second-year students were of non-traditional age. Some younger students may also be seeking "retraining" after entering the workforce at an early age, but for present purposes we will only consider the older students.

Among first-year students, traditional age students were much more likely than older students to perceive ET programs as "too difficult." This difference was not found among second-year students. Given that second-year students take remedial courses at higher rates, and such courses are designed to prepare students with the skills they need to succeed in ET, many first-year students may feel ET is too difficult because of inadequate preparation. Traditional age first-year students are also more likely to indicate that relationship with the instructor and knowing other students in the class are major reasons to stay in an ET course. Knowing other students is also a more important reason in choosing an ET class for these students than for older students. Social factors, which by nature relate to a student's attitude toward and comfort level with the class activity, were more important for younger students than older ones.

For non-traditional age students, lack of awareness of ET benefits was a more important reason students choose not to enroll. Since these students typically have not been in school recently, and haven't worked closely with counselors and instructors who might explain ET program options, they presumably are not exposed to sources of detailed information on the field.

Second-year students were asked about their educational objectives and motivations to study ET when they began their studies (one year earlier). Older students were more likely than younger ones to report earning a two-year degree (74% to 60%) and getting a better job in a field other than ET (21% to 7%) as their main educational objective. Social factors were again important for younger students, as more of them reported their main motivation for studying ET one year ago to be encouragement from family or friends (19% to 9%).

What are the demographics and academic background of entering ET students? Tables III-1 and III-2 describe the background of the entering ET students we sampled. Interested readers should peruse those tables carefully. In general, entering students are predominantly: male, white, employed at least part-time, need some remedial instruction, unmarried, do not have children, live over 10 miles from their institution and have not previously studied ET.

Many important differences exist between students of different genders and ethnicity. Nearly half of first-year white females (49%) who had declared a major field were in EGT and more than half of minority males (54%) were in EET. These rates are both far higher than for white males (EGT 20% and EET 37%). On the other hand, rates of majors among female and minority students in MET, CET, and other ET fields are much lower than for white males. These rates are all comparable among second-year students.

Thirty-one percent of entering students had taken an ET course prior to that semester. Students who had taken ET courses previously felt much more academically prepared than students who had not. This finding, combined with the overwhelming faculty perception that preparation is a key factor in student persistence, and the finding (discussed below) that remedial education improves preparation and persistence, suggests that technical college students should take preparatory classes *before* enrolling in regular ET courses and majors.

The vast majority of entering ET students indicated they planned to pursue an ET degree at their current college (lowest percentage by gender and ethnicity was 67% for minority males). However, among second-year students, far fewer ET students indicated this was their objective. Instead, the vast majority of students from all gender and ethnic groups reported transferring to a four-year institution was their current academic objective (lowest percentage was 70% for minority females, N=10). The percentages of second-year students indicating their academic objective was to earn an ET degree at their current institution dropped to less than 10 percent in all cases (highest was 8% of minority males). An important question is how respondents understood "academic objective." Some of these respondents probably intend to complete an ET degree, but also plan to attend a four-year institution. Moreover, the two groups are independent, and so do not represent a change of attitudes over time for a cohort. However, given the high difference in responses between the two independent groups, there appears to be a substantial drop-off in intent to complete an ET degree from the first year to the second. Why? Further research on actual student outcomes in comparison to stated intent is needed to investigate this issue.

How many students previously enrolled in developmental studies (DVS) courses enter ET programs? How many successfully complete ET programs? Remedial, or developmental, education is common among both first-year and second-year students. Among first-year students, 55 percent had taken at least one DVS course before enrolling in the regular ET program. The most common courses taken were mathematics (76%) and English (54%). Strikingly, a full two-thirds of second-year students (67%) had taken some remedial courses, with mathematics (86%) and English (61%) again the most common. The increases in overall DVS course-taking and taking mathematics courses are both significant (at the $p < .01$ and .05 levels, respectively).

This finding strongly suggests that taking remedial courses, and mathematics courses in particular, is positively associated with persistence. Although the samples are independent, the two student cohorts are similar in every demographic area. Thus it is reasonable to assume that their persistence patterns of the first-year students will be similar to those of the second-year group. Remedial course-taking appears to be a strong predictor of persistence at least until the second-year of ET study. This study does not include analysis of actual completion data, which is needed to answer the next question: "Do more students who take remedial courses graduate from ET programs than students who do not?" As stated earlier, such a study is feasible using the tracking data gathered on both student cohorts and should be undertaken as a follow-up to the current research.

What are the primary instructional methods in ET programs? What are student and faculty opinions of those methods? Lecture and laboratory experiences are still the predominant instructional methods in most ET programs. Applied or "hands-on" methods, group-learning, problem-based and related modern pedagogical methods are becoming more common at most institutions, especially through faculty participation in the SC ATE Center and Exemplary Faculty (EF) project. Nearly half of responding faculty (49%) had participated in the EF project, and thus are at least aware of and may to some extent be using modern pedagogical methods. *(Editor's note: These active learning pedagogical methodologies are becoming more apparent as the new ATE curriculum was pilot tested in 1998-99 and, in the 1999-00 academic year, will be alpha tested in a number of South Carolina technical colleges.)*

All faculty reported being directly involved in college apprenticeship programs, with the most common area being automotive (42%). Thus workplace learning is included to some extent in all responding ET faculty's instructional activities. Faculty also reported substantial industry involvement in educational activities as they relate to promoting retention. Responding faculty cited internships (17%), faculty mentoring (27%) and in-plant laboratories (10%) as examples of relevant industry support for instruction.

Faculty members are highly in favor of expanding workplace learning opportunities for students. In particular, they report that both current and past school-based work experience has a

highly positive effect on persistence. They are especially in favor of creating new job shadowing, apprenticeship and summer ET workshop programs to increase retention (all were judged very effective, on average). On average, they are less positive about programs to increase recruitment (no new program received more than a "somewhat effective" rating).

Overall, faculty appear to believe increasing work-related educational experiences will improve both the quality of instruction and the likelihood that students will persist and complete ET degrees. Follow-up research should address the extent to which active learning, group-learning and other applied instructional methods are related to retention and to work-based learning to increase instructional quality and persistence.

First-year students generally prefer applied or "hands-on" projects (51%), although white male students (56%) preferred these methods more so than female and minority students. More female and minority students feel they learn equally well with all instructional methods (lowest, 36% among minority females) than white males (28%).

Lower percentages of second-year students preferred applied or "hands-on" projects (41%). Overall, 31 percent of second-year students had no preference among instructional methods, and differences between gender and ethnic groups were not significant.

It would be worth investigating the relationship between preferred instructional method and persistence. One hypothesis suggested by these data is that many instructors use lecture and laboratory methods, but a large number of entering students prefer applied methods; because they are not taught using applied methods, they drop-out, resulting in the observed preferences of second-year students. The difference between first-and second-year preference for applied methods is significant, but actual persistence data should be examined using the preference data before drawing any conclusions. This question could be answered by analysis of student enrollment data from students in the first-year cohort.

What support systems are in place statewide to ensure student retention in ET programs? What are faculty, administrator, and student perceptions of them? The current research did not collect data on specific programs of student support. Student data were collected regarding perceptions of the quality of college programs and associated support services.

Seventy-seven percent of first-year students reported their ET courses satisfied their educational needs "quite a bit" or better; 62 percent rated the quality of facilities and resources at their college "high" or better; and 60 percent said their college offered more than sufficient student services (e.g., tutoring).

Among second-year students, 72 percent students reported their ET courses satisfied their educational needs "quite a bit" or better; 55 percent rated the quality of facilities and resources at their college "high" or better; and 54 percent said their college offered more than sufficient student services (e.g., tutoring). It is interesting to note that all of these percentages dropped from the first-year student levels (all $p < .05$). These data suggest that overall perceptions of programs, student support, and facilities are not associated with persistence. However, actual persistence and completion data should be examined to confirm this hypothesis.

Substantial numbers of first-year students indicated their decision to continue studying ET would depend "quite a bit" or more on student services (36%) and financial aid (41%). Significant differences were observed between white and minority students with respect to financial aid and student services: Minority students are far more likely than white students to indicate these factors would have a strong effect on their decision to continue studying ET.

Nationwide, minority students are more likely to come from lower socioeconomic status (SES) households, and South Carolina economic data suggests the state is no exception. Thus it is likely that retention is in fact significantly lower among minority students who fail to receive financial aid or receive insufficient aid.

Moreover, nationwide data indicate minority students are more likely to come from educationally disadvantaged backgrounds, with South Carolina again representative. Thus it is reasonable to conclude they are, in fact, in greater need of tutorial and other support services than

white students. The adequacy of such services is likely to be a significant factor in retention and completion. Follow-up study of student persistence to the second-year and completion would provide more complete answers to these questions.

What are the academic and demographic characteristics of ET graduates? Of ET dropouts? These questions cannot be readily answered from this research alone. Having collected tracking data on first- and second-year students, we are in a position to analyze state- or institution-level graduation data. Such a study would involve comparing demographic and attitudinal data from students participating in this study to enrollment outcome data for those same students. How long does it take students who take remedial courses to finish an ET degree as compared to students who do not take such courses? How many drop out? These questions should be addressed in a follow-up analysis utilizing data from the present study and student retention and completion data.

How do faculty and students interact in ET programs? What are each groups perceptions? Are there differences in perceptions based on gender or ethnicity? This question is best answered by noting several significant associations between observed demographic characteristics and attitudes and practices related to retention, including:

- Traditional age and male students are more likely than older and female students to choose ET courses and decide to stay in them based on "social" factors such as whether other students they know are taking those same courses;
- Students with children, of traditional age, and who are members of minority groups are initially motivated to study ET by their "social network", namely by encouragement from a) family or friends or b) instructors or counselors;
- Female students decide to stay in ET courses based on instructor support;
- Female students are less likely than males to report being encouraged to study ET by a work environment based on teamwork and group learning;
- Second-year female students are more likely than first-year students to feel that their college offers ET classes at convenient times;
- White students, especially males, and students who are already employed full-time or studying part-time are primarily motivated to study and continue studying ET by economic reasons such as getting a new or better job;
- Students employed full-time are highly motivated by subject matter;
- Minority students are more likely than white students to report financial aid and student support services are critical to their continued ET enrollment;
- Minority students are less likely than white students to consider subject matter a major factor in choosing or deciding to stay in an ET course;
- Minority students are less likely than white students to rate employer encouragement to take ET courses as a major factor in choosing or deciding to stay in them;
- Students who take remedial courses are more likely than those who do not to believe lack of preparation, lack of awareness of benefits and length of time it takes to complete the program keep students out of ET programs;
- Students who have at least some prior ET instruction are more likely than those who do not to feel well prepared to study ET; and,
- More second-year than first-year students have a strong relationship with their instructor.

Instructors and students: The relationship between instructors and students is a major factor in enrollment, retention and student success in ET programs. For younger students, minority students and students with children, the main initial motivation to study ET was encouragement from an instructor or counselor. Younger students are predominantly entering ET programs from high school, or after a brief period in another postsecondary environment or in the workforce.

Thus they may not have been exposed to ET as an educational or career option through other means, such as the workplace. Advice from a teacher or counselor may be their only way of learning about ET.

National data indicate minority students are more likely to come from more economically and educationally disadvantaged backgrounds, thus many of them are less likely to be exposed to ET directly while in school. Thus they need instructor or counselor support in order to choose ET.

Responding students with children were a highly mixed group: some single, some married, some younger, some older. There is no clear cut reason for the importance of instructor support to their decision to study ET. One explanation may be lack of exposure to other sources of information about ET, as in the case of minority students, because they have been out of school tending to child rearing.

Female students, more so than males, indicated instructor support was a major factor in deciding to stay in ET courses. ET is traditionally a male-dominated field, and many prospective female ET students probably do not receive encouragement from their other social networks, jobs or other sources. Thus instructors are more important to their success in class. Instructors who take a traditional attitude, encouraging only male participation in ET, likely discourage female students, while more progressive instructors provide women with a greater opportunity to continue and succeed in their courses. An interesting question not answered by this study is what classroom factors encourage female students to persist in specific courses, and ET programs in general.

More second-year students indicate they have a strong relationship with their ET instructors than first-year students. This finding indicates that second-year student persistence is associated with how well they interact with and learn from their ET instructors. What is less clear is what factors associated with instruction make students feel this way. Fewer second-year students than first-year students said they preferred applied or "hands-on" instruction. Lecture-based classroom teaching still predominates in many ET classrooms and is only now beginning to change due in part to the influence of the SC ATE Center and Exemplary Faculty project. Students who persist until the second-year may do so in part because they prefer, or at least learn reasonably well in, a lecture format. Further analysis of study data showed that only 40 percent of second-year students who had a strong relationship with their instructors also preferred applied instructional methods compared to 49 percent of first-year students who had both strong instructor relationships and preferred applied methods ($p < .05$). This hypothesis should be further investigated by comparing actual retention data for first-year students who preferred and those who did not prefer applied methods.

Gender and ethnicity: A major obstacle to this study was the small sample of female students. With 85 percent of first-year and 86 percent of second-year students being male, comparisons between male and female responses to questionnaire items were unlikely to yield significant population differences. However, there were a few salient results.

Female students have different motivations, and are encouraged in different ways, to study ET as compared to male students. Females do not appear to have strong "social networks" of friends or family encouraging them to study ET, presumably because of the traditionally male-dominated nature of the field. They are also less likely to be motivated to study ET because of economic reasons such as getting a better job in ET. This may be because fewer of them work in ET-related jobs. Because of the small sample of females, this hypothesis could not be further tested by comparing responses of males and females employed in jobs related to their ET major.

Interestingly, females are less likely to be encouraged to study ET by teamwork- or group-learning-oriented work environments. No collected data permit further investigation of this difference, but identifying associations between this attitude and women's workplace experience would provide an avenue for possible program interventions. Do women simply work in these environments less often, or do they work in these situations as often as men, but receive less encouragement to study ET from the "team" or "group learning" environment?

Perhaps the most important finding related to ethnicity was that minority students are more likely to base their decision to study ET on receiving financial aid and student support services. As discussed earlier, national data suggest minority students, especially African-American students, are less well-off financially and are less well-prepared academically when they begin postsecondary study. It is reasonable to conclude from these data that minority students who do not receive necessary financial aid, and what they perceive as sufficient tutorial and other student support, are likely to drop out. This is clearly an area to which South Carolina technical colleges should pay close attention and may need to design new interventions. This is discussed further in Section V.

Further analysis of this issue would involve comparing retention and completion data by reported student intentions from the present study and actual financial aid and student services received. Examining student "need" for support services based on entrance test scores, remedial education taken and ET academic achievement would also provide useful findings.

V.   Recommendations

Based on the findings of this research, what feasible program strategies should the SC ATE Center develop and implement? Recommendations are made in the areas of faculty, administrators, student services, employers, and statewide marketing to enhance both the recruitment of new students and retention of current students.

Faculty

Female students need instructor support to persist in ET courses. Focus groups should be conducted with ET faculty statewide to learn more about how faculty relate to and provide support for all ET students and how support may differ for male and female students. Administrator, counselor and other staff support for female ET students should also be examined. Faculty should be encouraged to promote female student achievement and to be aware that female students may not receive the same level of social, academic and workplace support for their ET studies as male students. Based on focus group results, some form of "sensitivity" training or information dissemination to encourage faculty to attend to the needs of female students might be needed.

Research on teaching and learning has shown that many students are more successful in learning environments that emphasize applied and problem-based instructional methods. These pedagogies are already becoming more common in South Carolina ET classrooms due to SC ATE. However, faculty should be made aware of the relationship between using these methods and increased enrollment and retention. Results of this study that address the issue should be provided to faculty in a clear, easily digested format. Additional research on the topic should be conducted. SC ATE should:

a.   Create "information briefs" (i.e., short topical fliers or brochures) on special issues such as the relationship between teaching methods and retention, and provide these to faculty on a regular basis;

b.   Incorporate measurement of the use of applied and problem-based curricula and instruction into future research on recruitment and retention issues, and analyze existing data on persistence and completion in relation to use of the SC ATE pre-ET and core curricula.

Faculty and administrators believe that recruitment is best enhanced by 1) direct faculty outreach to high schools and 2) summer programs for students. They believe retention is best enhanced by workplace-oriented experiences for students (i.e., "extending the learning environment into the workplace) through increased internship and co-op education opportunities.

These ideas align with SC ATE Center goals and objectives. Faculty should be encouraged to take initiative and begin such programs on their own or in teams and to support new initiatives at their home institution. SC ATE should consider hosting an issues forum (e.g., one-day workshop) or providing specific mentoring or formal training to faculty related to initiating such activities.

Finally, many faculty who received the faculty and administrator questionnaire did not fully complete it. Anecdotal information suggests this may have been because they were not involved in campus programs related to recruitment and retention or did not consider themselves knowledgeable about these issues. Part of the information dissemination described earlier should involve a general effort to increase faculty awareness of the importance of recruitment and retention for institutional strength, to promote student success and to serve the Technical College System mission of training students to enter the state's technical workforce.

Administrators

The same strategies used for faculty should be used for administrators. Seventy percent of respondents to the faculty and administrator survey performed some combination of ET teaching and administrative duties. Only 21 percent were exclusively classroom teachers. Administrators should participate in the focus groups, possible sensitivity training, and receive information disseminated to faculty.

Because some administrators are partially or primarily involved in institutional governance and financial matters, additional dissemination related to the benefits of increased female and minority enrollment and retention for cultural diversity on campus, and on institutional finances should be conducted. Case studies of results from other postsecondary systems that have increased diversity could be obtained and disseminated to administrators. Also, "data briefs" on the effects of increased enrollment and retention on tuition and fees revenue should be provided to administrators. Naturally, they are aware that more students means more revenue, but clear presentations of the effects of even modest increases in student FTE over time would have a powerful effect.

Finally, administrators need to consider whether more can be done to address financial aid issues related to minority students. Further research is needed, but there is reason to believe additional financial aid will need to be made available to substantially increase minority enrollment and persistence. Administrators should be made aware of the issue, shown evidence supporting minority student perceptions and need, and provided opportunities for discussion and planning. An administrator-only forum focused on this issue (e.g., a two-three hour teleconference using SCETV) would be valuable. Given that additional financial aid funds may be very hard to come by, administrators should consider creative mechanisms for minority financial aid, such as redistributing existing funds to minority students through competitive scholarships and incentive programs for based on academic achievement.

Student Services

Student support services, including tutoring, counseling, career advising and other assistance is important for all students, but especially minority students. SC ATE should encourage a review of ET student support services at each campus and identification of strengths and weaknesses. Using a "Strengths, Weaknesses, Opportunities, and Threats" (SWOT) approach with a facilitator would be valuable. This would be an appropriate activity for the Chief Instructional Officer (CIO) organizational change initiative to address. After completing the SWOT process, CIOs would have a better understanding of student services issues, especially those facing minority students, and could work with SC ATE to develop appropriate interventions. These might include:

- Additional resources in targeted areas (e.g., more math tutorial services);
- Services focused on the needs of specific groups of students;
- Outreach to employers and community;

- Including student representatives in campus planning for support services; and,
- Changes in student services methodology.

In addition to support services, this study indicates remedial education is associated with retention. Again, more research is needed, but second-year students predominantly have completed at least one DVS course, usually mathematics, suggesting that taking such courses promote retention. Many students may not need remediation according to established criteria, but may be, in fact, still deficient in one or more academic areas. SC ATE and the CIOs should consider raising proficiency levels in mathematics and other fields required to advance into regular ET courses. The Pre-ET curriculum is a step in the right direction. This curriculum should be coupled with a review of entry criteria into ET programs. Despite clear cut reasons to move students into regular ET courses as soon as possible, academic preparation is absolutely essential to persistence and completion. This fact is further reinforced by findings from the faculty and administrator survey, which indicated academic preparation is the most important factor in student persistence, and lack of preparation the main reason students drop out.

Employers

Findings from this study show employer encouragement for ET study is a factor in at least some student decision-making about taking ET courses and completing an ET degree. Faculty believe increasing workplace learning opportunities would be the most beneficial retention initiative SC ATE could undertake.

Employer representatives should be included in all campus recruitment and retention committees and planning activities. Employers could participate in the proposed CIO SWOT analysis related to enrollment and retention, or could participate in a follow-up activity with the CIOs once the SWOT analysis in completed. SC ATE could build on the current workplace research activities by creating employer-faculty teams on each campus devoted to recruitment and retention issues. The CIO might also participate with these teams on a limited basis to provide oversight.

In addition to opportunities for employer input, this study suggests prospective and current female and minority ET students need additional employer support. Further research is needed to determine if these students simply aren't in jobs that encourage employee ET enrollment and degree seeking, or whether some form of bias might be involved.

In any case, employers need to be aware that in order to increase the supply of skilled engineering technicians, more women and minorities will need to graduate from ET programs. As American society becomes more diverse, the pool of prospective technicians will include increasing numbers and an increasing proportion of women and minorities. More of these students will need to be enrolled in ET programs and will need to complete degrees in order for employer workforce needs to be met. Employers must understand this. SC ATE should respond by reaching out to employers through "information briefs" and "data briefs" such as those suggested above for faculty and administrators. Additionally, SC ATE should invite employer representatives to all meetings to promote diversity in recruitment and retention.

Statewide Marketing

Many students are not aware of the benefits or opportunities presented by ET. Data indicate lack of awareness cuts across gender, ethnic, age and other boundaries. Thirty-four percent of all first-year respondents indicated students like themselves chose not to enroll in ET programs because they were unaware of program benefits.

At the same time, faculty and administrators suggest that direct outreach to high schools would be an effective means of promoting enrollment. Faculty indicate making presentations to high school students about ET would encourage enrollment. Again, the suggestion is to provide information about why ET is a good educational and career option. Clearly there is a need to

inform prospective students and family, friends, business and community members who are involved in their decisions. But how?

Students who are likely to have been away from school for an extended period of time are more likely to be unaware of ET program benefits. Among first-year students, those age 25 and over, those who are married, and those who have taken some remedial courses, all are more likely to be unaware of ET benefits. Combined with faculty input on likely beneficial program strategies, these data suggest a two-pronged marketing strategy. Part one would focus on students still in high school, and part two would focus on returning, older students.

Before initiating these two strategies, SC ATE would undertake focus group market research with completing students and with members of social and community networks that are involved in student decision-making to attend ET programs (e.g., family, friends, counselors). The purpose of these focus groups would be to develop an enhanced knowledge base about promotional strategies. They would seek to answer questions such as: What do the two identified prospective student groups—high school age and returning, non-traditional—want to know about ET? What are their concerns? What obstacles do they face? How can technical colleges address these issues? Results would be incorporated into the marketing strategies for each group.

For high school students: SC ATE would develop a comprehensive school-based ET information campaign. This would involve regular visits to area high schools and presentations by faculty members of all major ET disciplines—including EET, EGT, MET, CET—during the academic year. Students would be informed of major elements of each discipline, academic requirements, job opportunities, expected salary levels, advancement potential and so on. Where feasible, employer representatives from relevant companies (e.g., a manager in a graphics firm with an EGT faculty member) might co-present at some high school events. The goal and emphasis of these presentations would be to make ET exciting and within the grasp of the average student.

In the spring of each year, high school juniors and seniors would be recruited to attend summer ET workshops at the local technical college. Some amount of screening would probably be advisable (e.g., minimum GPA in relevant courses, completion of appropriate high school mathematics, some technology background, stated interest in pursuing ET). Students would attend the summer workshop and learn in-depth about selected ET fields, requirements and opportunities. These students would be tracked through an evaluation activity, and their rate of enrollment and retention compared to non-participating students. Revisions to this workshop program would be made based on findings.

For non-traditional students: SC ATE would create and disseminate professionally-produced brochures describing careers in ET to major community venues statewide, including employers, churches, civic organizations, clubs and so on. The brochure would include promotional information similar to that presented by faculty at the high schools. The brochure would be culturally sensitive and could be supported by information from supplementary focus groups with completing students from target groups (e.g., exit sessions with older students, women re-entering the workforce, members of minority groups as they finish their ET degrees). Additionally, faculty would make presentations at these same venues similar to those at the high schools. Employers would host sessions and participate with faculty in presentations.

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*Differences significant at the p < .05 level. Scores reflect mean responses on scale of 0-1, with higher scores reflecting higher level of agreement with the statement.

^ Differences significant at the p < .01 level. Scores reflect mean responses on scale of 0-1, with higher scores reflecting higher level of agreement with the statement.

[1] Differences significant at the p < .05 level. Scores reflect mean responses on scale of 1-5, with higher scores reflecting higher level of agreement with the statement.

[2] Differences significant at the p < .05 level. Scores reflect mean responses to a yes or no question (range 1-2) with higher scores reflecting more yes responses.

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Section II
Fostering Underrepresented Student Enrollment and Graduates

The Special Issues Committee of the South Carolina Technical College System Chief Student Services Officers Peer Group conducted a study, *Fostering Underrepresented Student Enrollment and Graduates*, to determine what SC technical colleges were doing well to recruit and retain women and minority students. These findings were presented at the SC ATE 1998 Retention Forum.

Recommendations included:

- Conduct recruitment activities through such programs as Tech Prep, Job Training Partnership Act, local high school career centers, scholarship programs for minority high school seniors, adult education, Job Service, counseling/admissions/recruitment activities, and the use of Access and Equity funds to develop a minority recruitment prospect list.
- Sponsor career day activities and tours of campus.
- Develop contacts and relationships in the community, including involvement in community associations.
- Publicize financial aid and scholarship information.
- Build a diverse faculty and emphasizing sensitivity to diversity issues.
- Enlist students who have had a positive college experience to play a major role in recruiting other students, particularly in the African-American community.
- Create literature to target the minority community.
- Ask African-American graduates to serve as mentors for new students.
- Provide special support for students who are low income, first-generation college students, and making special efforts to assist female students in adjusting to the predominately male environment in ET fields.
- Provide flexibility with assignments, availability of unscheduled office hours and counseling as needed.

Section III
Recommendations from Faculty Focus Groups

Ninety South Carolina technical college educators, participating in a retention forum sponsored by the SC ATE Center of Excellence, met in focus groups to develop strategies for enhancing recruitment and retention of engineering technology students. A consensus of the strategies discussed included:

Recruitment/Retention
- Make students aware of career options at an earlier age. Work with parents and K-12 teachers. Be proactive in "selling" engineering technology careers.
- Work with high schools to communicate to students the type of academic background necessary to be adequately prepared for engineering technology programs.
- Use former students to recruit.
- Initiate talent search programs through summer programs or pre-engineering technology course.
- Develop social support system for engineering technology careers through the community and parent education programs.
- More clearly define the profession.
- Improve college outreach programs to the high schools.
- Advertise student success stories.

- Pair a new student with a successful continuing student.

Student Services Issues/Financial Aid
- Consider making tutoring available for all students, regardless of financial qualifications. Tutoring could be offered through a designated tutoring center in an academic building, where tutoring could be provided days and evenings. Tutors should be diverse in terms of age, gender and race. Tutors should be familiar with different learning styles. Instructors could make referrals to the center, striving for early interventions. Tutoring services would be provided at no cost to the students; however, tutors need to be paid more to attract quality tutors.
- Provide financial aid information multiple times, beginning at recruitment, and make the information more accessible on campus.
- Consider a program that would match students with college programs for which they are eligible, including scholarships and financial aid. Students are often reluctant to ask questions or don't know whom to ask.
- Establish programs to help with emergency situations, including transportation and childcare issues.
- Strengthen the advising process to ensure appropriate placement of students.
- Encourage good interpersonal relationships between students and faculty and counselors. Encourage stronger linkages between instructors and advisers.
- Examine how student services can better meet the needs of minority and female students.
- Provide more software/technology tools for advisement and for communicating with students.

Curriculum
- Offer short courses in the summer to serve newly graduated high school seniors.
- Initiate bridge course rather than remedial courses.
- Give students an advance look at ET careers through the Pre-ET (pre-engineering technology classes); they are interested in technology.
- Provide opportunities for students to improve study and time management skills.
- Use classroom teaching techniques focused on: working in teams, active learning/collaborative learning, integrated curriculum, learning styles, multiple intelligences, mentoring, coaching, internships, co-ops and industry shadowing opportunities.
- Develop distance education courses and other alternate delivery systems.
- Identify best practices for replication in other programs and colleges.

Faculty Development
- Help faculty members stay current on industry trends.
- Institute a process for following up with students who have had to drop out temporarily.
- Promote positive relationships between faculty, staff and students.
- Get more involved in the community, promoting engineering technology occupations with sixth through 12th graders. Go to elementary schools and PTA meetings, talking about what engineering technology is and what technicians do. "There is no product that sells itself."
- Talk in the community about what you, as a faculty member, do.

Section IV
Recommendations from Women and Minority
Second-Year Engineering Technology Students,
Panel discussion

Women and minority second-year ET students from technical colleges throughout South Carolina participated in a panel discussion of ET issues at the SC ATE retention forum. Their comments provide important insights into student perspectives and concerns. The issues they raise can guide us as colleges strive to provide the support necessary to enable students to be successful and allow postsecondary institutions to meet the demands for highly skilled engineering technology technicians in a technology-driven marketplace.

Why did you choose engineering technology?
- Motivated by economic factors, good pay, more career options.
- Can provide a better life for my family.
- Advisement at the technical college.
- Interested in computers, electrical engineering.
- Preparation for four-year degree in engineering.

What contributed to your success?
- Family support.
- Instructor support.
- Tutoring.
- Wanted to be role model for children.

What barriers did you face?
- Demanding schedules, with job and family responsibilities.
- Been out of school for some time.
- Class scheduling sometimes a problem (when had two-hour break between classes).
- Little family support for female students in ET.
- Transportation.
- Math.
- Maturity.

Recommendations to improve the recruitment and retention of minority and female students in ET programs:
- Better access to financial aid information.
- Students need to know options available to them; students don't always know how to find the information they need.
- Advisers should be familiar with students' high school transcripts. Advisers and counselors should set a realistic pace for students; they should recommend against taking too big a class load in an effort to finish quickly.
- Need low-cost babysitting services.
- Need African-American and women tutors; need mentors.
- Like co-op opportunities.
- Need good recruiters.

Conclusions

This research demonstrates that there are many proactive steps that can be taken to positively affect recruitment and retention in two-year engineering technology programs. Educators and industry leaders should work together to communicate the viability of engineering technology careers at the earliest stages possible in the educational process. This would accomplish two key

objectives: (1) More clearly define the profession and career opportunities for parents, students and K-12 teachers; and (2) Ensure that more students are academically prepared for success in engineering technology programs.

Research indicates that appropriate advisement/placement, instructor and family support, and student services and financial aid are important to student persistence, particularly for women and minority students. Students and faculty see easy and convenient access to information, such as financial aid information, as necessary to strengthen recruitment and retention efforts. A diverse faculty, sensitive to the needs of a diverse student population, is also highly desirable. Research also suggests that establishing multiple connections to the kindergarten through 12th grade system, strengthening associations with industry and enhancing relationships within the community are vital to recruitment and retention in engineering technology programs.

The research discussed in this monograph seems to suggest that the approaches provided by the new SC ATE curriculum (pre-engineering semester and first-year ET core) will meet many of the needs identified by students and faculty and lead to improved retention. Results of the 1998-99 curriculum pilot tests and implementation results from the 1999-2000 academic year appear to bear out the positive effects on retention. Student retention rates ranged from 71% to 94% in fall of 1998 and averaged 88% in fall of 1999. (The typical student retention rate for all open enrollment, associate degree college programs nationwide is about 50%, according to ACT institutional data.) Student enrollments almost doubled in one year, increasing from 50 in 1998 to 96 in 1999. Outpacing overall enrollment growth, female participation increased from 3 to 18 in one year, while African-American participation increased from 11 to 42.

Strengths of the new curriculum include:

- Use of the Pre-ET (now called Technology Gateway) preparatory courses, rather than remedial courses, to meet the needs of underprepared students.
- Incorporation of more hands-on instruction, which appeals to first-year students.
- Additional faculty support made possible by interdisciplinary teaching teams.
- Use of problem scenarios and learning strategies such as teaming that model the workplace.
- Incorporation of effective teaching methodologies and concepts, such as active learning/collaborative learning, coaching, multiple intelligences and instructional technology. The SC ATE teaching approach supports the success of a diverse population of learners.
- Inclusion of communications as part of the integrated curriculum.
- Use of technology for research, problem solving and presentations throughout the curriculum.
- Connections made between subject areas (and between subject areas and the workplace) in the integrated curriculum.
- Involvement of industry representatives in curriculum development.
- Recognition of the value of industry-related experience for students and workplace research for faculty.

The SC ATE Center of Excellence is continuing its work on recruitment and retention of engineering technology students as South Carolina's technical colleges phase in implementation of the SC ATE Pre-ET/Technology Gateway and first-year ET core curriculum. The new curriculum—with its integrated, problem-based learning approach--is itself part of the Center's recruitment and retention strategy.

The focus on recruitment and retention will strengthen engineering technology programs and participating colleges, enhance student success and support the South Carolina technical college system's mission to promote economic development by providing a high quality technical workforce.

References

Evans, E. Douglas, *Determinants of Enrollment and Retention in South Carolina Engineering Technology Programs*, Evaluation Research Associates, SC Advanced Technological Education Center of Excellence, 1998.

The Special Issues Committee of the South Carolina Technical College System Chief Student Services Officers Peer Group, *Fostering Underrepresented Student Enrollment and Graduates*, presented at the SC ATE 1998 Retention Forum.

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