What Can The Past Tell Us About Our Future? Trends and Developments in Engineering Technology

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Abstract

A group of engineering technology educators collaborated in 1977 to develop a longitudinal survey to look at trends and developments of baccalaureate engineering technology programs in the United States. Representatives of the Engineering Technology Division (ETD) four zones of the American Society for Engineering Education (ASEE) conducted the survey in 1977, 1981, 1985, 1990, and 1995. The results of these surveys were reported by region and published in the 1978, 1982, 1986, 1991, and 1996 College Industry Education Conference (CIEC) proceedings.

The first time the longitudinal survey was conducted nationally in 1998 after members of Engineering Technology Division and the Two-Year College Division (TCD) of ASEE came together to sponsor the 1999 Trends and Development survey. All two- and four-year engineering technology schools were invited to participate in the web-based survey that was conducted during the fall of 1999. Various invitations to participate in the study were sent out to the ETD and TCD listservs. A total of 129 institutions participated in the 1999 Engineering Technology Trends and Development Survey. Of all the participating institutions, 62 were four-year schools and 67 were two-year schools. This represents a participation level of approximately 31% of the total number of engineering technology schools/institutions in the United States.

The second national survey was conducted during the fall, 2003. Most of the questions have remained the same from the 1999 survey. A total of 67 institutions responded to the survey, 47 were four-year schools and 20 were two-year schools. Obviously, the number of participating institutions is smaller than the number that participated in the 1999 survey.

Results of the 1999 and 2003 surveys will be compared to determine what changes have occurred over the four-year period. This paper will report on the significant differences, changes, trends, and developments in engineering technology education.

Administrative Structure

The first part of the survey is administrative in nature asking questions concerning the type of institution, title of administrator, name of degree awarded, number of credit hours

required for degree, sharing of faculty space with other programs, number of courses with technical laboratories, etc. In this section, the survey did not change considerably from the 1999 survey.

In 2003 of the 37 four-year schools that responded, 79% reported that they are known as a university. Interestingly, 79% of the respondents in 1999 also said they were called a university. The next most used name is college at 13%.

Table 1. Type of Institution for Four-Year Schools 1999 and 2003.

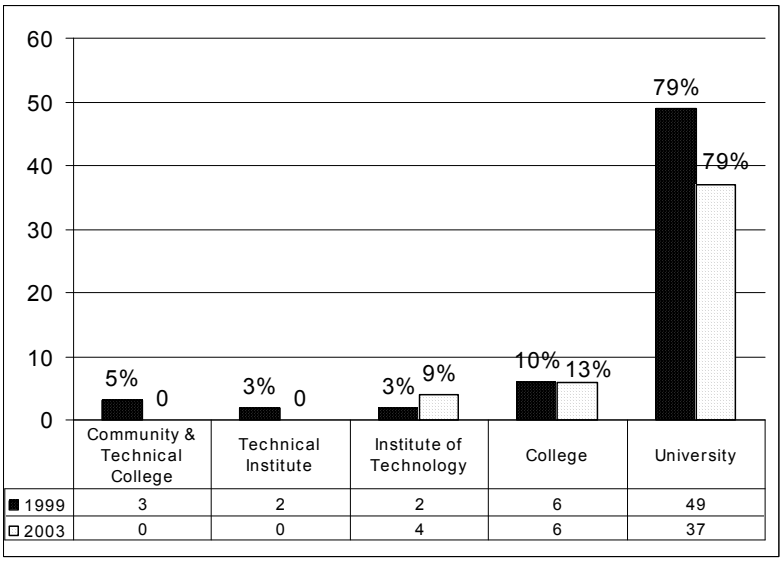
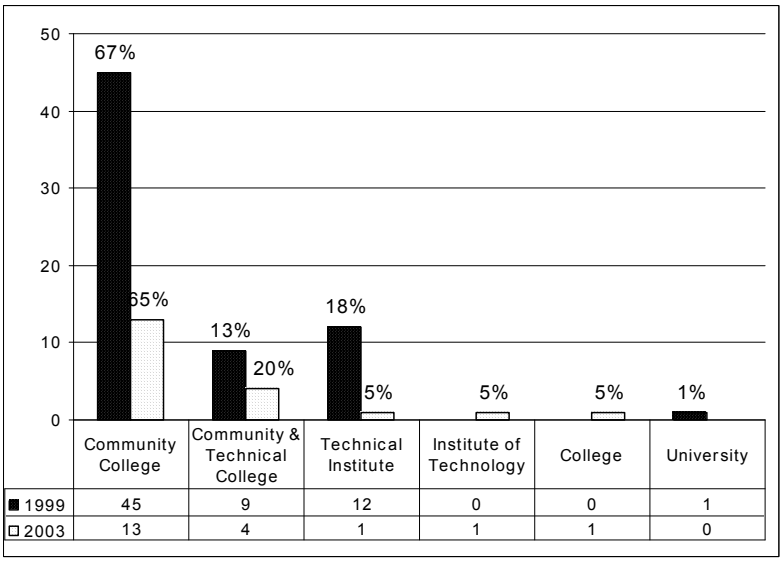


Table 2. Type of Institution for Two-Year Schools 1999 and 2003.



A majority of the two-year schools, are still called community colleges as indicated by 65% of the responding institutions in 2003, likewise in 1999, 67% of the two-year institutions were called community colleges. Only a handful that responded are called community and

technical colleges. However, a search on Google.com revealed at least thirty plus colleges with the word "technical" in their name.

Of the respondents in 2003, 40% of four-year schools responded that the title of the person directly in charge of the engineering technology program(s) is a chair, 25% responded dean, 15% responded director, and 10% responded head. In summary, a typical four-year engineering technology program is housed in a university and directed by a department chair.

Two-year school leadership titles, in 2003, were evenly split between dean and chair at 33% each, followed by the title of head at 17%, then followed by director at 11%. In summary, a typical two-year engineering technology program is housed in a community college headed by a dean or director.

For both groups, in 2003 as well as in 1999, the most likely title of the administrative unit was Engineering Technology as opposed to Technology, Science or Applied Science, Engineering & Technology, Engineering, or Technology and Applied Science.

Ninety-four percent of the four-year schools award a Bachelor of Science degree to their graduates. Additionally 78% of the two-year schools award an Associate of Applied Science degree, followed by 16% awarding an Associate of Science degree.

Forty-eight percent of four-year schools responded that they require between 129 and 136 credit hours for the bachelor degree. Another 46% responded that only 120 to 128 credit hours are necessary for a bachelor degree. In 1999, the difference was about the same with 42% requiring 120 to 128 credit hours and 45% requiring 129 to 136 credit hours. There was no consistency with the two-year institutions with regards to how many credit hours were necessary for an associate degree. The count was split four ways 28% for 61 to 64 credit hours; 22% for 65 to 68 credit hours; 28% for 69 to 72 credit hours; and a 22% for 73 to 76 credit hours.

Over 72% of the two-year schools reported that more than 80% of their technical courses include a required laboratory as compared to only 31% of the four-year schools.

Administrators in four-year programs will be interested to know that 40% of the two-year institutions reported that only 0 to 10% of their graduates pursue a bachelor degree immediately after they complete their associate degree. Likewise at four-year schools, 87% responded that less than 0 to 10% of the graduates with a bachelor degree immediately enroll in a Master's degree program.

In the area of industrial committees, 88% of two-year schools reported that they have an industrial advisory committee for each of their associate degrees. Eighty-three percent of the four-year schools have industrial advisory boards for each of their Engineering Technology (ET) bachelor degree programs. Schools were asked nine questions on how effective their industrial committees or boards are in various supporting roles of the school. On the next page, Table 3 and Table 4 show the four-year school and two year school responses in percentages, respectively.

Table 3. Four-year School Responses in Percentage of Effectiveness of Industry Committees

Industrial Advisory Committee Provides	Very Effective	Effective	Ineffective	Very Ineffective	Not Applicable
Curriculum guidance	27%	68%	5%	0%	0%
Student scholarships	5%	34%	27%	20%	14%
Co-op employment	9%	64%	9%	9%	9%
Placement for graduates	14%	64%	16%	2%	4%
Recruiting students	2%	39%	39%	7%	13%
Equipment resources	5%	48%	27%	9%	11%
Field trips or training material	21%	54%	9%	9%	7%
Summer employment for faculty	5%	27%	27%	20%	21%
Research/sponsored projects for faculty	2%	32%	29%	14%	23%

Comparisons of the data in Tables 3 and 4 indicate that advisory committees for four-year schools are somewhat more effective in providing resources than two-year school advisory boards. Nearly 60% of both groups replied that they met with their advisory committees a minimum of two times a year.

Table 4. Two-year School Responses in Percentage of Effectiveness of Industry Committees

Industrial Advisory Committee Provides	Very Effective	Effective	Ineffective	Very Ineffective	Not Applicable
Curriculum guidance	23%	65%	6%	0%	6%
Student scholarships	0%	18%	29%	24%	29%
Co-op employment	6%	41%	18%	12%	23%
Placement for graduates	12%	53%	23%	0%	12%
Recruiting students	0%	23%	59%	0%	18%
Equipment resources	0%	35%	47%	6%	12%
Field trips or training material	0%	71%	23%	0%	6%
Summer employment for faculty	0%	12%	24%	35%	29%
Research/sponsored projects for faculty	0%	0%	24%	41%	35%

Faculty

The second section of the trends and development survey is about faculty. This section of the survey looks at the number of funded faculty vacancies, faculty attrition, percent of annual salary increase, criteria for promotion, degree requirements of faculty, age of the faculty, professional growth budget, part-time faculty usage, recruitment of part-time faculty, etc.

Twenty-eight percent of four-year schools and 12% of two-year schools reported at least one vacant engineering technology position in 2003. The number of vacant positions has changed from the 1999 survey as indicated in Tables 5 and 6 located on the following page.

Table 5. Four-year Schools Funded ET Vacant Positions 1999 and 2003

Funded ET Vacant Positions	1999	2003
0	40	41
1	42	28
2	10	11
3	4	17
More than 3	4	2

Table 6. Two- year Schools Funded ET Vacant Positions 1999 and 2003

Funded ET Vacant Positions	1999	2003
0	62	88
1	18	12
2	15	0
3	3	0
More than 3	3	0

Sixty percent of the four-year schools and 53% of the two-year schools both indicated that they lost faculty to industry within the last four-years. From the 1999 data, faculty attrition to industry shows an increasing trend with only 44% of the four-year schools and 22% of the two-year schools indicating attrition in 1999.

Salary increases for faculty have remained somewhat stable since 1998-99 with four-year schools reporting a 2-4% increase by 80%, 79%, 74%, 78%, 61%, and 72% for the years 1998-99, 1999-00, 2000-01, 2001-02, 2002-03, and 2003-04 consecutively. The two-year-schools reporting a 2-4% increase by 75%, 62%, 81%, 69%, 75%, and 50% for the years 1998-99, 1999-00, 2000-01, 2001-02, 2002-03, and 2003-04 consecutively. The very noticeable difference being that in 2003-04 the salary increases were split 44% less than 2% and 50% at 2-4% for two-year institutions.

Schools were asked to indicate the percentage of each criterion for promotion and tenure consideration. On the following page, Table 7a & 7b indicate the promotion and tenure criteria for four and two-year schools by percentage for 1999 and 2003 for comparison. Teaching remains the dominant criteria for promotion for both groups. This is no surprise given the historic emphasis on teaching. Research has increased in both two- and four-year schools. There was a decrease in scholarship in the 4-year schools which could account for the increase in research. Terminology or definition of the terms could be a factor or account for the changes in these areas. However, in the two-years schools scholarship remained the same while research increased slightly over the four year period.

Table 7a. Comparison of Promotion Criteria Percentages for Four-Year Schools

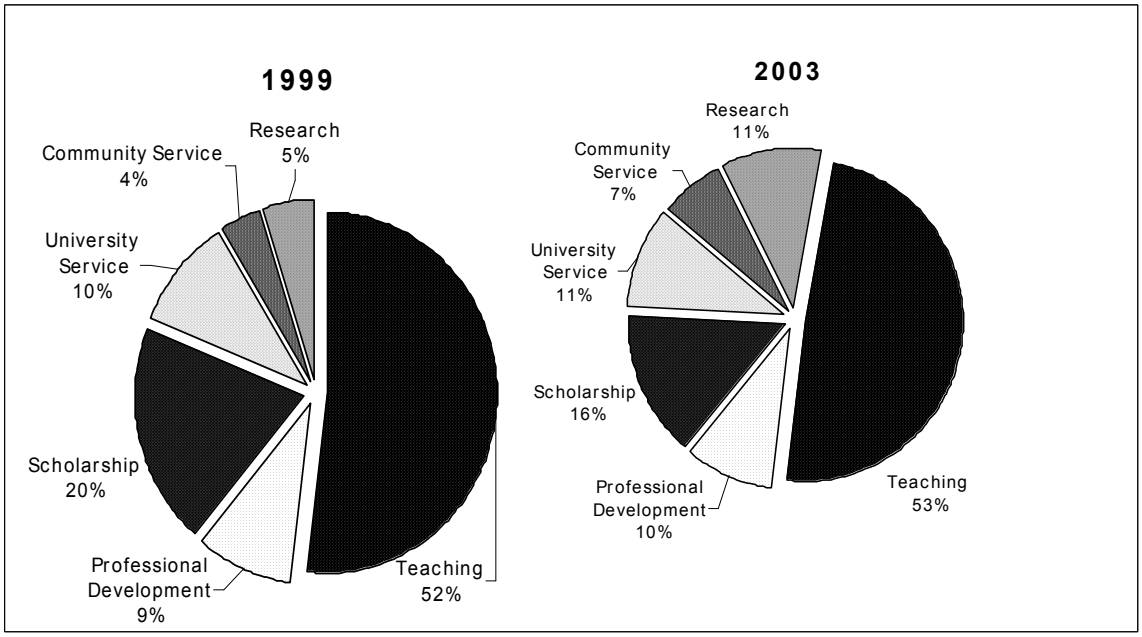
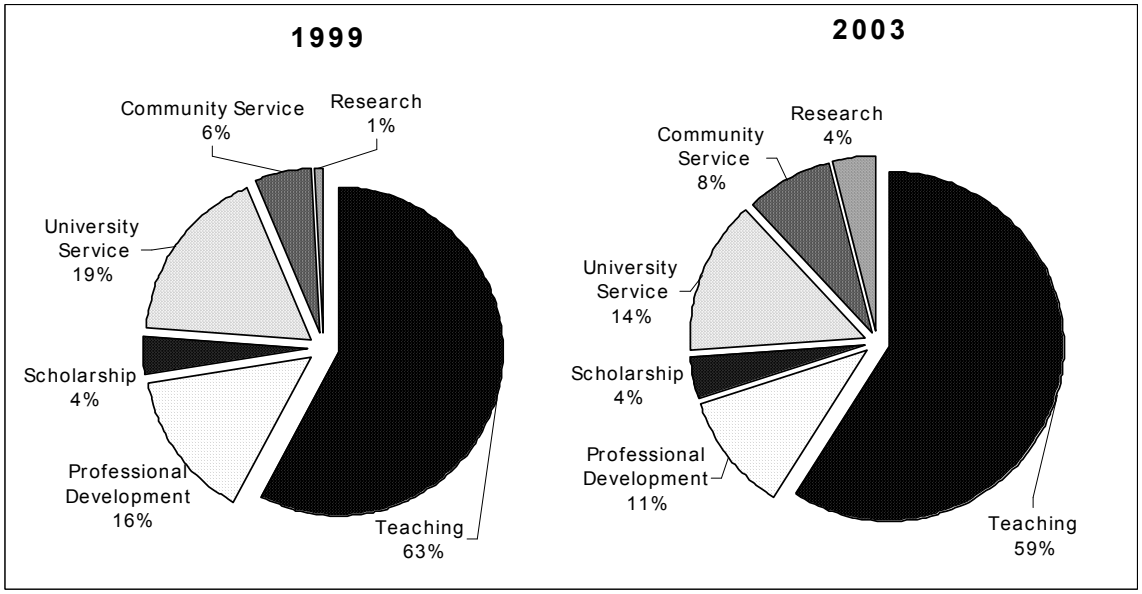


Table 7b. Comparison of Promotion Criteria Percentages for Two-Year Schools



In 1999, when two-year institutions were asked to respond to a question concerning the presence of a faculty union/collective bargaining contract, 67% indicated yes, however, in 2003, only 38% indicated yes. Four-year institutions answered 23% affirmative to that question in 1999 and 27% affirmative in 2003.

In 2003, 87% of the four-year schools indicated that the minimum degree requirements for faculty are a master's degree, 11% indicated a PhD. and 2% have a bachelor degree as a

minimum requirement. For two-year schools, 63% have a minimum of a bachelor degree while 37% have a minimum of a master's.

The good news is that the average age of faculty is getting younger. Table 8 indicates from 1999 to 2003 a small shift or turnover in faculty. A greater percentage of the faculty are in the 40 to 49 range in 2003 than in 1999 for the four-year schools.

Table 8. Percent Average Age Range of Faculty for Four- and Two-year Schools 1999 and 2003

	1999	2003		1999	2003
	Four-year	Four-year		Two-year	Two-year
Age Range	%	%		%	%
25-39	4%	2%		2%	18%
40-49	42%	54%		52%	25%
50-54	50%	40%		33%	25%
55-59	4%	4%		3%	21%
60+	0%	0%		10%	11%

Four and two-year schools indicated that they have budgeted funds for faculty professional growth which could include travel, sabbaticals, conferences, workshops, etc.

Twenty-five percent of two-year schools indicated that less than 20% of their faculty are part-time while 69% of the schools indicated no part-time faculty were used. Seventy-four percent of four-year schools use 20% or less part-time faculty while 11% of the four-year schools used 20 to 40% part-time faculty and another 11% used 41 to 60% part-time faculty. There seemed to be was a heavier reliance on part-time faculty at four-year schools than two-year schools in 2003.

A larger number, 50%, of four-year schools indicated that they had a hard time recruiting part-time faculty than the two-year schools although the number was still rather high for two-year schools at 44% indicating difficulty.

In 2003, only 20% of four-year schools are involved in international exchanges or programs. There as a decrease from 1999 when the total was 30%. For two-year schools, the number is 6% involved in international exchanges or programs, this represents a decrease from 1999 when the total was 10%.

Student Characteristics

The third section of the survey looks at student characteristics such as percentage of minority, female, physically disadvantaged and the average age of student populations.

A larger portion of two-year institutions indicate that the average age of students in their engineering technology program is less than 30. A major portion of the four-year schools indicated the range their average age student is 21 to 23 followed by the next largest percentage which indicted a range of 24 to 26.

Table 9. Percentage of Female Student Population for 1999 and 2003

	1999	2003		1999	2003
	Four-year	Four-year		Two-year	Two-year
Females	%	%		%	%
Less than 5%	10%	33%		27%	25%
5- 10%	53%	40%		39%	19%
11- 20%	31%	25%		26%	50%
21 -50%	6%	2%		8%	6%
More than 50%	0%	0%		0%	0%

The maximum age of a student reported by four-year schools was 65 or less and 40 or less for two-year schools. Life long learning is demonstrated in these numbers.

Minority percentages remained about the same from 1999 to 2003 for four-year schools, however, two-year schools decreased slightly during the same time period as indicated in Table 10.

Table 10. Percentage of Minority Student Population for 1999 and 2003

	1999	2003		1999	2003
	Four-year	Four-year		Two-year	Two-year
Minority	%	%		%	%
Less than 5%	29%	28%		20%	25%
5- 10%	27%	30%		15%	19%
11- 20%	13%	21%		32%	25%
21 -50%	27%	16%		30%	25%
More than 50%	4%	5%		3%	6%

Enrollment, Recruiting, Retention, Placement and Follow-up

This section looks at the result of questions on enrollment history, enrollment projections, percentage of completion of degree, placement of graduates, starting salaries of graduates, alumni activities, fall enrolment by program, and graduation rates by program.

Targeting women and minorities in engineering and engineering technology education has been a focus for the future. When asked if they have specific programs directed at recruiting women and minorities, four-year schools answered by indicating 47% have programs for women and 42% have programs for minorities. Two-year schools answered the same question indicating that 49% have programs for women and 42% have programs for minorities.

The majority of the four-year schools characterized their enrollment history from 1999-2003 in a growth state. Exactly, 68% indicated a growth while 32% characterized the same period with a decline. For two-year schools the opposite was true 69% saw a decline while 31% experienced a growth.

The four-year schools were asked what percentage of freshman class completes the BS degree in engineering technology within five years. Two-year schools were asked a similar question about completing the associate degree within three years. The results for 1999 and 2003 are tabulated in Table 11.

Table 11. Percent Completion of Degree for Four- and Two-year Schools for 1999 and 2003

	1999	2003		1999	2003
	Four-year	Four-year		Two-year	Two-year
Completion of Degree	%	%		%	%
Less than 20%	7%	5%		26%	0%
20-40%	37%	24%		39%	56%
41-60%	21%	29%		26%	31%
61-80%	23%	27%		4%	13%
More than 80%	12%	15%		5%	0%

Both four and two-year schools indicated that they have retention programs directly targeted at women and minorities. Forty percent of the two-year schools have retention programs for women and 60% have retention programs for minority students. Forty-one percent of the four-year institutions have retention programs directed at women while 48% have programs specifically for minority students.

All schools were asked what percent of the engineering technology graduates have discipline related employment at or near graduation. Sixty-eight percent of the four-year institutions indicated that more than 80% of their graduates had discipline related employment while only 44% of two-year institutions indicated the same percentage of more than 80%. The percentage was practically the same in 1999 for the four-year schools. But for two-year schools the placement of 80% or more in 1999 was only 34%.

Starting salaries for new associate and bachelor degree graduates are varied as shown in Table 12.

Table 12. Starting Salaries for New Associate and Bachelor Degree Graduates

	2003	2003
	Two-year	Four-year
Starting Salary		
under $20,000		
21,000 - 25,000	25%	
26,000 - 30,000	31%	
31,000 - 35,000	31%	5%
36,000 - and over	13%	
36,000 - 40,000		16%
41,000 - 45,000		38%
46,000 - 50,000		32%
51,000 - 55,000		7%
56,000 and over		2%

Four-year institutions actively engage alumni in ongoing department activities. Fifty-six percent of the four-year schools responded affirmatively to the question, however, only 19% of the two-year schools replied positively. Likewise when asked if alumni contribute to the engineering technology alumni fund, two-year schools responded 100% no. Fifty-four percent of the four-year schools receive contributions from their alumni.

Conclusion

The results presented in this paper are taken from the data collected from participating two- and four-year schools in a national survey conducted during the fall 2003. While the sample size is much smaller for 2003 than in 1999, the information is still valuable for engineering technology administrators. The 2003 National Trends and Development Survey Report is scheduled to be completed and released by the end of spring 2004. The final report may vary slightly from the results presented in this paper because of accepting late entries into the data base. This paper only addresses some of the 130 questions that the survey includes. The survey report will be distributed to participants and will be reported at the ASEE 2004 Conference. The report will include results of approximately 130 questions concerning administrative features, programs, faculty, student characteristics, enrollment, recruitment, retention, and follow-up for engineering technology two and four-year programs.

References

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