

## HOW IMPORTANT IS EFFECTIVE TEACHING TO ENGINEERING FACULTY AND ADMINISTRATORS?

**Catherine E. Brawner, Richard M. Felder, Rodney H. Allen, Rebecca Brent**  
**Research Triangle Educational Consultants/ North Carolina State**  
**University/ COMP-AID/ North Carolina State University**

### Abstract

The Southeastern University and College Coalition for Engineering Education (SUCCEED) has among its goals persuading and preparing engineering faculty to adopt effective teaching practices and improving the campus climate for undergraduate engineering education. To these ends it has designed and implemented a faculty development program that includes teaching effectiveness workshops, workshops for administrators on mentoring and supporting new faculty, and measures to create and sustain engineering faculty development programs on each member campus. To assess the impact of these efforts, the SUCCEED faculty development team designed and administered a survey of faculty teaching practices and attitudes toward teaching in 1997<sup>1</sup> and administered it again in 1999<sup>2</sup>. This paper summarizes the responses to survey items in which faculty rated the importance of effective teaching to themselves, to faculty colleagues, and to campus administrators, and the importance of effective and innovative teaching in their institution's faculty reward system.

In 1999, the survey respondents rated the importance of effective teaching to themselves very high, averaging 6.5 on a 7.0 scale. They rated its importance to their colleagues, department heads, deans, and top institutional administrators significantly lower, with the averages ranging from 5.1 to 5.6. Their ratings of the importance of effective and innovative teaching in the reward system were still lower—3.7 and 3.5, respectively. Significant differences in ratings were found by gender, primary academic function (teaching, teaching/research, and administration), involvement in SUCCEED, rank, and Carnegie Foundation classification of the institutions. All significant changes from 1997 to 1999 were in the negative direction. Our conclusion is that while SUCCEED's faculty development efforts have had noteworthy positive effects in changing faculty instructional practices<sup>2</sup>, much work still remains to be done to create a sense among the faculty that efforts to improve teaching will be appreciated or rewarded.

### Introduction

SUCCEED is one of a number of multi-university coalitions sponsored by the National Science Foundation to improve engineering education in the United States. It comprises eight engineering schools—Clemson University, Florida A & M and Florida State Universities (which have a joint engineering program), Georgia Institute of Technology, North Carolina A & T University, North Carolina State University, University of Florida, University of North Carolina

at Charlotte, and Virginia Polytechnic Institute and State University. SUCCEED was originally funded in 1992 for five years, and its funding was renewed for another five years in 1997.

At the beginning of its second five-year funding period, SUCCEED formed several focus teams, including one to coordinate faculty development (FD) activities. As part of the FD program, a survey was designed to track the SUCCEED faculty's instructional practices, involvement in instructional development programs, and perceptions about institutional support for teaching on their campuses. The survey was first administered in the 1997-98 academic year<sup>1</sup>; a modified version was administered in 1999<sup>2</sup>; and a third administration will take place in the spring of 2002.

### Survey Methodology

The survey was initially sent to all 1621 SUCCEED faculty members with e-mail addresses, and a month later faculty who had not responded were sent a follow-up survey. Duplicate responses were determined by e-mail addresses and, if available, the real names of the respondents. In cases of duplication, the first survey returned was used in the analysis and the second was discarded. After blank surveys and duplicates were eliminated from the returns, 586 valid and usable surveys remained, for a return rate of 36%.

Ninety-one percent of the 579 respondents who reported their sex were men. Tables 1 and 2 show the respondents' rank by primary academic function and engineering discipline. The mean time spent as a faculty member was 15 years (SD = 10.68) and the time at the current institution was 12 years (SD = 9.43). The longest service by a current faculty member was 49 years. Assistant professors averaged just over 3 years as a faculty member at their current institution (SD = 3.25), associate professors averaged 11 years (SD = 6.36), and full professors averaged nearly 18 years (SD = 8.75). There were no significant differences in the demographic make-up of the 1997 and 1999 samples using the Chi-square test for independence. The demographic profile of the respondents closely matched that of the full faculty with respect to sex, rank, position, engineering discipline, and level of participation in faculty development programs<sup>2</sup>.

The survey responses were classified according to the respondents' sex, rank, position, and years of service, the Carnegie classification<sup>3</sup> (research or masters) of their schools, and their level of involvement with SUCCEED and prior attendance at teaching seminars. The responses were then subjected to either t-tests or one-way analysis of variance (ANOVA) to detect significant differences within these categories, with the Bonferroni multiple comparisons procedure being used to compare mean responses among the various groups. Levene's test for equality of variances was used with the t-tests to determine the appropriate degrees of freedom. If the degrees of freedom indicated in the report are reported to the tenth (e.g., 872.4 or 78.0), Levene's test indicated that the variances were not equal. For the purpose of determining significant differences, alpha was set at 0.05.

To identify significant differences among groups, it was necessary to eliminate certain low-incidence groups from further analysis within these groups or to combine categories. For these purposes, an "instructor/lecturer" who was also a woman would be excluded from analyses of the data by rank but included in analyses by sex. Taking this step improves the likelihood that

significant differences found among the groups are meaningful rather than simply statistical artifices.

The following adjustments to the data were made:

- Within the rank category, only assistant professor, associate professor, and (full) professor categories were investigated. This decision eliminated 53 people who listed their rank as instructor/lecturer, adjunct/visiting, emeritus/retired, or other, or who did not list their rank.
- Within the current position category, only teaching, teaching/research, and administration categories were investigated. In addition, department heads were combined with “dean’s office/other administration” category in some instances, particularly to compare the 1999 results with the 1997 results. This decision eliminated 19 people who listed their position as research or other.
- Within the level of involvement in SUCCEED category, the 4 people who indicated that their involvement level was “other” were eliminated.

In addition, to get a more realistic portrayal of those faculty who currently teach undergraduates, the 75 people who indicated that they had not taught undergraduates during the prior three years were asked to answer demographic questions only. This is a substantive change from the 1997 survey in which those faculty members were not systematically eliminated, so some survey respondents in 1997 may have provided information about their teaching behavior that was not current.

Table 1  
Rank by primary academic function

Rank	Current Position						Total Row %
	Teaching	Teaching Research	Research	Dept. Head	Other Admin.	Other	
Assistant Professor	8 7%	111 90%	3 2%	1 <1%	1 <1%	0 0	124 22%
Associate Professor	15 10%	136 87%	3 2%	2 1%	0 0%	1 <1%	157 27%
Professor	16 6%	184 74%	10 4%	23 9%	15 6%	2 <1%	250 44%
Instructor/ Lecturer	7 64%	0 0%	0 0%	1 9%	0 0%	3 27%	11 2%
Adjunct/ Visiting	4 50%	1 13%	3 38%	0 0%	0 0%	0 0%	8 1%
Emeritus/ Retired	2 29%	3 43%	1 14%	0 0%	0 0%	1 14%	7 1%
Other	0 0%	2 12%	8 47%	0 0%	2 12%	5 29%	17 3%
Total	52	437	28	27	18	12	574
Column %	9%	76%	5%	5%	3%	2%	100%

Table 2  
Engineering discipline of respondents

Discipline	n	%
Chemical	39	7
Civil and Environmental	112	19
Computer Science*	22	4
Electrical/ECE	109	19
Industrial and Systems	61	11
Ceramics and Materials	26	4
Mechanical and Aerospace	131	23
Other**	78	14

Notes: \*Computer Science is not in the College of Engineering at all schools. These numbers only represent computer science faculty who are in the College of Engineering.

\*\*Includes Agricultural, Architectural, Coastal, Freshman, Mining and Minerals, Nuclear, and Textiles Engineering, Engineering Science and Mechanics, Engineering Technology, and College of Engineering

### Survey Items Related to Teaching Effectiveness and Innovative Teaching

The following paragraphs and questions were part of the 1999 survey:

*Questions 5-10 refer to "teaching quality." By this we mean teaching that sets high but attainable standards for learning, enables most students being taught to meet or exceed those standards, and produces high levels of satisfaction and self-confidence in the students.*

*In Questions 5-11, please rate the importance of teaching quality and innovation on a scale from 1-7 with 1 meaning "not at all important" and 7 meaning "extremely important." Please use whole numbers*

5. *How important is teaching quality to you?*
6. *How important do you feel teaching quality is to most of your department faculty colleagues?*
7. *How important do you feel teaching quality is to your department head?*
8. *How important do you feel teaching quality is to your dean?*
9. *How important do you feel teaching quality is to the top administrator at your university?*
10. *How important is teaching quality in your institution's faculty incentive and reward system (recognition, raises, tenure, promotion)?*
11. *How important is teaching innovation (testing new methods, writing textbooks or instructional software) in your institution's faculty incentive and reward system (recognition, raises, tenure, promotion)?*

To avoid syntactical difficulties, the phrase “effective teaching” will henceforth be used in place of “teaching quality,” and “innovative teaching” will be used for “teaching innovation.”

In the 1997 survey, the responses to Items 5–11 were in the range 0–10, where 0 = “not at all important” and 10 = “extremely important,” while the 1999 survey responses were in the range 1–7 as shown above. To allow comparisons between the 1999 and 1997 survey results, the 1997 responses were rescaled using the formula  $y = 1 + 0.6x$  (where  $x$  is the 1997 response) and rounded to the nearest integer, so that 0 converts to 1, 1 and 2 to 2, 3 and 4 to 3, 5 to 4, 6 and 7 to 5, 8 and 9 to 6, and 10 to 7.

### Findings

The responses to Items 5–11 of the 1999 survey are summarized in Table 3. The data show that respondents rated the importance of effective teaching to themselves quite highly. They gave their department heads significantly lower ratings than they gave themselves and they gave their colleagues, dean, and top administrator significantly lower ratings than they gave their department heads. In fact, all of the pairs of means shown in Table 3 except those that share the subscript “a” are significantly different from each other at the  $p \leq .0005$  level.

Table 3  
Rated importance of effective and innovative teaching

<u>Importance of</u>	<u>To</u>	<u>Mean</u>	<u>Std. Dev.</u>	<u>N</u>
Effective Teaching	Respondent	6.50	0.71	511
“	Colleagues	5.21 <sub>a</sub>	1.24	507
“	Dept. Head	5.58	1.31	506
“	Dean	5.14 <sub>a</sub>	1.49	496
“	Top Administrator	5.10 <sub>a</sub>	1.52	487
“	Reward System	3.71	1.49	504
Innovative Teaching	Reward System	3.50	1.42	501

These results are substantially similar to those from 1997 with a few exceptions. The average rating of the importance of effective teaching to colleagues decreased significantly from a mean of 5.42 in 1997 to a mean of 5.21 in 1999 [ $t(961.2) = 2.979, p = .003$ ], and the rated importance of innovative teaching in the institutional reward system decreased from 3.72 in 1997 to 3.50 in 1999 [ $t(982) = 2.517, p = .012$ ]. The lowered rating of the importance of effective teaching to colleagues was evident as well in a few of the subgroups, as shown in Table 4. Table 5 shows that the ratings of the importance of effective and innovative teaching in the institutional faculty reward structure decreased significantly from 1997 to 1999 at research institutions, as did the rated importance of innovative teaching among those who attended one teaching seminar in the prior year.

Table 4

Change in rated importance of effective teaching to colleagues from 1997 to 1999

Group	1999		1997		Difference		
	M (SD)	n	M (SD)	n	M (SE)	t (df)	p
Male	5.26 (1.19)	423	5.45 (.96)	397	-.18 (.08)	2.43 (800.3)	.015
Research Institution	5.19 (1.21)	403	5.44 (.97)	373	-.25 (.08)	3.14 (758.9)	.002
Teaching Faculty	4.93 (1.47)	45	5.48 (1.05)	44	-.54 (.27)	2.02 (79.6)	.047
Teaching/Research Fac.	5.17 (1.21)	377	5.35 (.99)	341	-.18 (.08)	2.14 (709.1)	.033
Attended 1 teaching seminar last year	5.19 (1.15)	108	5.61 (.93)	142	-.41 (.14)	3.04 (202.3)	.003
Attended $\geq 10$ teaching seminars in career	4.97 (1.21)	111	5.35 (1.04)	62	-.38 (.18)	2.09 (171)	.038

Table 5

Importance of effective teaching and innovation in the faculty reward system

Research Institutions	1999		1997		Difference		
	M (SD)	n	M (SD)	n	M (SE)	t (df)	p
Importance of effective teaching in reward system	3.63 (1.48)	403	3.84 (1.39)	373	-.21 (.10)	2.07 (774)	.039
Importance of innovative teaching in reward system	3.49 (1.43)	403	3.73 (1.39)	373	-.24 (.10)	2.35 (774)	.019
Attended 1 teaching seminar last year							
Importance of innovative teaching in reward system	3.46 (1.35)	108	3.83 (1.28)	142	-.37 (.17)	2.20 (248)	.029

Significant differences were found among the 1999 subgroups for a number of the responses related to effective teaching. Not surprisingly, respondents who were actively involved in SUCCEED rated its importance to themselves significantly higher ( $M = 6.68$ ,  $SD = .57$ ) than did respondents who had heard of SUCCEED but weren't involved in it ( $M = 6.42$ ,  $SD = .76$ ). Full professors rated the importance of effective teaching to themselves ( $M = 6.58$ ,  $SD = .68$ ) and their colleagues ( $M = 5.38$ ,  $SD = 1.11$ ) significantly higher than did assistant professors ( $M = 6.35$ ,  $SD = .71$  to themselves and  $M = 4.98$ ,  $SD = 1.19$  to their colleagues). Ratings of associate professors fell between those of the two other faculty ranks and were not significantly different from either. Not surprisingly, faculty at research institutions rated the importance of effective teaching in the reward system significantly lower than did faculty at masters institutions, 3.63 to 4.03 [ $t(499) = 2.002$ ,  $p = .046$ ]. Table 6 shows that women rated the importance of effective teaching to their colleagues and their department head and the importance of effective and innovative teaching in the institutional reward system significantly lower than did their male counterparts.

There were also significant differences between respondents with different primary academic functions in ratings of the importance of effective teaching in the reward system. Administrators generally rated the importance of effective teaching to upper level administrators higher than did teaching and teaching/research faculty. The administrators also perceived effective teaching to be

a more important part of the faculty reward system than did rank-and-file faculty, although interestingly, there was no significant difference in the perception of the importance of innovative teaching in the reward structure. Table 7 displays the significant results.

Table 6  
Importance of effective teaching by sex of respondents

Importance of:	Male		Female		Difference		
	M (SD)	n	M (SD)	n	M (SE)	t(df)	p
Effective teaching to you	6.50 (0.70)	456	6.53 (0.71)	49	-.03 (.09)	0.247 (503)	.805
Effective teaching to colleagues	5.27 (1.19)	453	4.63 (1.52)	48	.65 (.23)	2.858 (53.2)	.006
Effective teaching to Dept. Head	5.63 (1.30)	452	5.10 (1.39)	48	.53 (.20)	2.674 (498)	.008
Effective teaching to Dean	5.19 (1.45)	442	4.88 (1.70)	48	.32 (.22)	1.425 (488)	.155
Effective teaching to top administrator	5.16 (1.50)	433	4.75 (1.64)	48	.41 (.23)	1.778 (479)	.076
Effective teaching in reward system	3.77 (1.47)	450	3.21 (1.52)	48	.56 (.22)	2.521 (496)	.012
Innovative teaching in reward system	3.56 (1.40)	447	3.02 (1.45)	48	.54 (.21)	2.531 (493)	.012

Table 7  
Importance of effective teaching by primary academic function

Importance of	Teaching		Teaching/Research		Administration	
	M (SD)	n	M (SD)	n	M (SD)	n
Effective teaching to you	6.80 <sub>a</sub> (.45)	50	6.45 <sub>b</sub> (.71)	405	6.72 <sub>ab</sub> (.53)	29
Effective teaching to colleagues	5.00 <sub>a</sub> (1.46)	49	5.18 <sub>a</sub> (1.21)	402	5.48 <sub>a</sub> (1.09)	29
Effective teaching to Dept. Head	5.57 <sub>a</sub> (1.43)	49	5.50 <sub>a</sub> (1.31)	401	6.48 <sub>b</sub> (.74)	29
Effective teaching to Dean	4.90 <sub>a</sub> (1.56)	49	5.11 <sub>a</sub> (1.47)	392	6.00 <sub>b</sub> (1.09)	28
Effective teaching to top admin.	4.71 <sub>a</sub> (1.61)	48	5.10 <sub>a</sub> (1.52)	385	5.93 <sub>b</sub> (1.12)	28
Effective teaching in reward system	3.66 <sub>ab</sub> (1.40)	47	3.66 <sub>a</sub> (1.49)	402	4.38 <sub>b</sub> (1.29)	29
Innovative teaching in reward system	3.62 <sub>a</sub> (1.55)	47	3.46 <sub>a</sub> (1.43)	399	3.79 <sub>a</sub> (1.08)	29

Note: Means in the same row that do not share a subscript are significantly different at the  $p < .05$  level using the Bonferroni test.

### Summary and Conclusions

Two components of SUCCEED's mission were to persuade faculty members to adopt instructional practices that were known to be effective at promoting learning (such as active and team-based learning) and to improve the climate for teaching on the coalition campuses. Efforts to achieve the latter goal included involving a large percentage of the faculty in coalition

programs and giving presentations to administrators on ways to help new faculty members become both more productive in research and more effective in teaching.

The 1999 survey revealed noteworthy success in achieving the first component of the mission (modifying instructional practices)<sup>2</sup>, but from the point of view of the survey respondents, the climate for teaching on their campuses was not particularly good in 1997 and worse in 1999. Most respondents expressed a belief that effective teaching (i.e., teaching that sets high but attainable standards, enables most students to meet or exceed the standards, and produces high levels of satisfaction and self-confidence in the students) was very important to them and decreasingly important to their department heads, faculty colleagues, dean, and top university administrator. There was also general agreement that effective and innovative teaching (testing new instructional methods, writing textbooks or instructional software) counted for very little in the faculty reward system. All significant changes from 1997 to 1999 were in the negative direction.

Women generally gave lower ratings of the importance of effective teaching to colleagues and administrators and in the reward system than did men, and assistant professors gave lower ratings than associate professors, who in turn gave lower ratings than full professors. Administrators consistently rated the importance of effective teaching to themselves and their colleagues and in the reward system higher than did the rest of the faculty. Predictably, ratings of the importance of effective teaching in the reward system were higher at masters institutions than at research institutions, but both ratings were quite low.

We infer from these findings that professors who spend time and energy participating in faculty development programs and learning and implementing new methods do so despite their general belief that their efforts will neither be appreciated by their colleagues nor rewarded by their administrators. (There is some comfort in the fact that respondents gave department heads the second-highest rating after themselves, indicating a belief that those who rise to that level feel that teaching is more important than it is to most rank-and-file faculty.) Nevertheless, the study shows that many of them choose to make the effort anyway, which we regard as a tribute to their dedication. The dramatic advances in the quality of American engineering education that might result from putting teaching and research on a more equal footing in the faculty reward system can only be imagined. Our hope is that the next survey administration in 2002 will reveal movement in this direction.

#### References

1. Brawner, C., Felder, R.M., Allen, R., Brent, R. (1998). *1997–1998 Faculty Survey of Teaching Practices and Perceptions of Institutional Attitudes Toward Teaching*. ERIC Document Reproduction Service, ED 428 607.
2. Brawner, C., Felder, R.M., Allen, R., Brent, R. (2001). *1999 Faculty Survey of Teaching Practices and Perceptions of Institutional Attitudes Toward Teaching*. ERIC Document Reproduction Service, in press. Available on-line at [http://www.succeednow.org/products/99faculty\\_survey.pdf](http://www.succeednow.org/products/99faculty_survey.pdf) >.
3. Carnegie Foundation for the Advancement of Teaching. (2000). <http://www.carnegiefoundation.org/classification/> >.



**CATHERINE E. BRAWNER**

Catherine E. Brawner is president of Research Triangle Educational Consultants. She specializes in evaluation of distance education, educational innovation, and technology use in the classroom. She has been the principal evaluator of the SUCCEED Coalition and currently advises the coalition on assessment and dissemination.

**RICHARD FELDER**

Richard Felder is Hoechst Celanese Professor Emeritus of Chemical Engineering at North Carolina State University and Faculty Development Co-director of the NSF-sponsored SUCCEED Coalition. He is a Fellow Member of the ASEE, and co-director of the National Effective Teaching Institute.

**RODNEY H. ALLEN**

Rod Allen is a research scientist and independent computer consultant. His company, COMP-AID, specializes in innovative applications, crisis consulting, e-commerce, Internet, computer aided design, computer graphics, efficient computing, and teaching computer courses, short courses, and seminars.

**REBECCA BRENT**

Rebecca Brent is an educational consultant on the staff of the College of Engineering at North Carolina State University, Faculty Development Codirector of the SUCCEED Coalition, Adjunct Professor of Education at East Carolina University, and co-director of the National Effective Teaching Institute.