FACULTY TEACHING PRACTICES AND PERCEPTIONS OF INSTITUTIONAL ATTITUDES TOWARD TEACHING AT EIGHT ENGINEERING SCHOOLS[*]

Richard M. Felder, Department of Chemical Engineering
Rebecca Brent, College of Engineering
Thomas K. Miller, College of Engineering
North Carolina State University
Raleigh, NC 27695

Catherine E. Brawner
Research Triangle Educational Consultants
Raleigh, NC 27612

Rodney H. Allen
COMP-AID
Research Triangle Park, NC

Abstract – All engineering faculty members in the eight universities that comprise the SUCCEED Coalition were surveyed about their use of a variety of instructional methods and their perceptions about attitudes toward teaching on their campuses. The results provide a unique snapshot of engineering education at a transitional moment in its history. The same survey will be administered two years and four years from now. The results should provide an indication of the degree to which the SUCCEED faculty development program is meeting its objectives, which are to promote faculty adoption of proven instructional methods and materials and to improve institutional support for effective teaching.

Introduction

SUCCEED (Southeastern University and College Coalition for Engineering Education) is a National Science Foundation-sponsored engineering education coalition. It was first funded in 1992 and began its second five-year period with a mission of scaling up and institutionalizing the educational reforms developed and pilot-tested in the first five years. A major component of this effort is the design and implementation of a faculty development program. The program objectives are (1) to promote faculty adoption of nontraditional instructional methods and materials that have been proven effective by classroom research studies and (2) to improve institutional support for teaching at each of the eight SUCCEED campuses.

As the first step in assessing and evaluating the faculty development program, a campus climate survey was sent to all engineering faculty members in the Coalition schools. The survey asked the responders about their use of a variety of instructional methods, their prior involvement in instructional development programs, and their perceptions about institutional support for teaching on their campuses. The survey was administered to some faculty members via email and to others via the World Wide Web during the period from December 1997 to February 1998. A second round of surveys was sent by email to non-responders in March 1998.

Survey Items

The responder is first asked to identify his or her university and department, and then to furnish responses to 39 multiple-choice items and an open-ended question asking for comments. The numbers in parentheses denote the number of multiple-choice items in each listed category.

- *Academic position* (3): Rank, primary job function (teaching, teaching/research, research, administration, other), length of faculty service.
- *Prior involvement with teaching beyond classroom instruction (education-related seminars, conferences, educational research)* (3): Total number of programs attended and number attended in previous year, level of involvement in SUCCEED projects.
- *Rated importance of teaching quality and innovation* (7): Importance (0–10 scale) to responder, department faculty colleagues, department head, dean, chancellor;

importance of quality and of innovation in faculty incentive and reward system.

- *Frequency of use of different teaching techniques* (17): Lecture most of class period, show overhead transparencies, use live or multimedia demonstrations, address questions to the class as a whole, put students in small problem-solving groups for brief intervals and for most of a class period, work at computer terminals in class, assign individual homework, assign optional and required group homework, assign a major group project, give writing assignments (requiring verbal explanations), use email communication with entire class, use the Web to provide information to students, write formal instructional objectives, give study guides before tests and before the final exam.
- *Involvement in teaching improvement programs on campus* (6): Presence of faculty development resources on campus, frequency and nature of faculty use of these resources, frequency of discussions of teaching with colleagues and of requests for feedback on teaching from students
- *Other* (3): Responder's gender, characterization of student ratings of his/her teaching and average department ratings.

Survey administration

Before the survey was conducted, we secured faculty lists from all eight campuses to use for demographic purposes and to keep track of the percentage of faculty members responding to the survey. All faculty members getting the survey were sent an introductory memo from a local campus administrator. The memo briefly summarized what SUCCEED is and why the survey was being conducted, assured confidentiality of the responses, gave instructions for completing the survey, and estimated a total time to respond of about ten minutes.

Percentages responding

Table 1 shows the percentages responding from the different coalition institutions. The response rate for the second survey is calculated as $N_{2nd}/(N-N_{1st})$, as those who responded to the first survey were not sent the second one. The final percentages ranged from a high of 51% to a low of 27%. (Response rates above about 25% are considered excellent in surveys of this nature.)

Table 1. Response rates.

| | | 1st Survey | | | | 2nd Survey | | | |
| | | e-mail | | Web | | | | Total | |
School	N	N	%	N	%	N	%	N	%
1	125	48	38%			16	21%	64	51%
2	72	14	40%	6	17%	9	17%	29	40%
3	336	32	10%			59	19%	91	27%
4	81	28	35%			2	4%	30	37%
5	199	51	26%			19	13%	70	35%
6	93	26	28%			12	18%	38	41%
7	325	79	24%			24	10%	102	31%
8	289	38	27%	23	16%	44	19%	105	36%
TOTAL	1520	316	22%	29	15%	185	8%	530	35%

The sections that follow present highlights of the survey response data. The complete data set will be contained in a forthcoming SUCCEED Coalition report.

E-mail survey vs. Web-based survey

Two versions of the survey were prepared, one email-based and one World Wide Web-based. In the first version, by selecting "Reply" the recipient could fill in the survey and send it back directly to the survey administrator. The second version sent an email message giving the recipient a unique identification number and instructions to access a Web site containing the survey, fill in the survey on-line, and submit it. The advantage of the Web-based survey is that a great deal of the tabulation, preliminary analysis, and record-keeping could be done automatically, where the email survey required manual entry of responses. The engineering faculties on two campuses were split randomly into two groups, one of which received the email version and the other the Web version.

Forty-five faculty members from School 2 and 148 faculty from School 8 were sent the email survey, and 46 faculty from School 2 and 149 faculty from School 8 were sent the Web survey. Response percentages are calculated

based on the number of respondents receiving each type of survey.

Investigation of the returns from the first survey administration made it clear that the data-handling automation provided by the Web-based survey at the two institutions where it was used did not compensate for the low rate of return associated with this mode of administration. We therefore abandoned this mode for the remaining institutions in the first survey administration and for all eight institutions in the second administration.

Demographics

The responders included

- 10% female, 85% male, 5% did not respond to this item.
- 3% instructors/lecturers, 19% assistant professors, 31% associate professors, 40% full professors, 5% "other" (mostly full-time administrators), 2% non-responders.
- 73% teaching/research faculty, 9% teaching faculty, 2% research faculty, and 13% administration or other, 3% non-responders.
- 8% with less than two years teaching experience, 12% 2–5 years, 20% 5–10 years, 32% 10–20 years, 26% more than 20 years, 2% non-responders.

Survey Responses

Involvement in Instructional Development Activities

- *Teaching seminars attended in career:* None–15%, one or two–25%, three to five–29%, six or more–28% (3% non-responders).
- *Teaching seminars attended in preceding year:* None–43%, one–29%, two–16%, three or more–9% (3% non-responders).
- *Knowledge about campus teaching center:* 62% said there was one, 6% said there was not, and 29% did not know (3% non-responders).
- *Utilization of campus teaching center:* Of the responders who had access to a teaching center, 3% made extensive use of it, 38% used it occasionally, 14% used it once, and 45% never used it.
- *Knowledge about SUCCEED Coalition:* 8% knew nothing about it, 54% had heard of it but were not involved, 12% had attended SUCCEED functions but were not active in the coalition, and 23% were actively involved (2% non-responders).

Use of Different Instructional Methods

The responders were asked about the frequency with which they used different instructional methods and were told not to respond if they taught only laboratories and project-based courses like design. The percentages to be given are based on those who responded to each item. The term "semester" may actually mean "semester" and "quarter".

- *Lecture for most of a class period:* 66% do so in every class session, 29% once or more per week, 3% once or more per month, 1% once or more per semester, and 1% never. (The responders were instructed to check the first response that applied to them.)
- *Overhead transparencies:* 25% use them in every class session, 33% once or more per week, 20% once or more per month, 15% once or more per semester, and 7% never use them.
- *In-class demonstrations:* 4% use them in every class session, 17% once or more a week, 34% once or more a month, 32% once or more a semester, 14% never.
- *In-class computer activities:* 1% use them in every class session, 4% once or more a week, 3% once or more a month, 11% once or more a semester, 81% never.
- *Brief in-class small group activities:* 4% use them in every class session, 14% once or more a week, 23% once or more a month, 17% once or more a semester, 42% never.
- *Extended in-class small group activities* (occupying most of a class period)**:** 1% use them in every class session, 6% once or more a week, 12% once or more a month, 21% once or more a semester, 60% never.
- *Individual homework assignments:* 54% give them 1–3 times a week, 31% 1–3 times a month, 7% 1-3 times a semester, 7% never.
- *Homework assignments that may be done individually or in teams:* 24% give them 1–3 times a week, 17% 1–3 times a month, 24% 1-3 times a semester, 34% never.
- *Homework assignments that must be done in teams:* 10% give them 1–3 times a week, 10% 1–3 times a month, 25% 1-3 times a semester, 55% never.
- *Writing assignments:* 8% give them 1–3 times a week, 28% 1–3 times a month, 48% 1-3 times a semester, 16% never.
- *Major team projects:* 24% assign them in every course they teach, 52% in some courses, and 24% never.
- *Email communication to entire class:* 25% use it at least once a week, 22% less than once a week but more than once a month, 18% once a month or less, 35% never.
- *Present information via the World Wide Web:* 27% do so at least once a week, 14% less than once a week but more than once a month, 21% once a month or less, 37% never.
- *Prepare instructional objectives for a course:* 39% always write them, 21% usually, 21% sometimes, 19% never.
- *Give study guides to students before tests:* 35% always do so, 24% usually, 21% sometimes, 20% never.
- *Give a study guide to students before the final exam:* 39% always do so, 21% usually, 17% sometimes, 23% never.

- *Solicit feedback from students:* 4% do so in every class session, 11% do so more than once per week, 27% more than once per month, 57% once or more per semester, 2% never.

Participation in Discussions of Teaching

- *Discuss teaching with colleagues:* 12% do so more than once per week, 39% less than once per week and more than once per month, 40% once per month or less, 5% never (3% non-responders).
- *Discuss teaching with graduate students:* 7% do so more than once per week, 21% less than once per week and more than once per month, 44% once per month or less, 15% never 9% do not work with graduate students (4% non-responders).

Student Ratings of Teaching

The responders were asked to characterize student ratings of their teaching and average student ratings for their department on a scale from 0 (extremely poor) to 10 (superior).

- *Responders' ratings:* N = 498, Mean = 7.91, Standard Deviation = 1.12, Minimum = 3, Maximum = 10.
- *Department ratings:* N = 485, Mean = 6.89, Standard Deviation = 1.04, Minimum = 1, Maximum = 10.

Rated Importance of Teaching Quality

The responders were asked to rate the importance of high quality teaching (defined as 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) and innovative teaching (testing new methods, writing textbooks or instructional software) to themselves, to their colleagues and administrators, and in their institution's faculty incentive and reward system (recognition, raises, tenure, promotion). They were told to use a 0–10 scale, with 0 meaning "not at all important" and 10 meaning "extremely important." The results are summarized in Table 2.

Table 2. Rated importance of high quality and innovative teaching.

Importance of	to	N	Mean	Std. Dev.	Min.	Max.
Quality	Responder	516	9.26	1.01	2	10
"	Colleagues	507	7.34	1.69	0	10
"	Dept. Head	506	7.70	2.14	0	10
"	Dean	500	7.02	2.26	0	10
"	Chanc./Prov.	490	7.02	2.16	0	10
"	Reward Syst.	504	4.72	2.24	0	10
Innovation	Reward Syst.	497	4.48	2.35	0	10

The pairwise differences in the mean values shown were subjected to t-tests. All differences were significant at or below the $p<.001$ level except for those between the dean and the chancellor/provost ($p=.7$) and between the importance of teaching quality and innovation in the reward system ($p = .003$).

Inter-institutional Differences

There were substantial variations in responses from different institutions. Some of the observed ranges follow. Numbers in parentheses are standard deviations.

- *Attended at least one teaching seminar:* Low=75%, High=97%
- *Attended 6 or more teaching seminars:* Low=24%, High=42%
- *Use brief in-class group exercises:* Low=47%, High=83%.
- *Use group exercises lasting most of a class period:* Low=34%, High=55%.
- *Assign required team homework:* Low = 35%, High = 72%.
- *Provide class information via the World Wide Web:* Low=56%, High=69%.
- *Importance of teaching quality* (0=not at all important, 10=extremely important)
  - *to responder:* Low=8.98(1.26), High=9.41(0.82)
  - *to colleagues:* Low=6.76(2.32), High=7.97(1.26)
  - *to department head:* Low = 6.66(2.92), High = 8.32(1.42)
  - *to dean:* Low=6.44(2.21), High=7.76(1.89)
  - *to president/chancellor/provost:* Low=6.03(2.41), High=7.80(1.76)
- *Importance of teaching quality in the faculty reward system:* Low=4.10(1.99), High=4.99(2.17)
- *Importance of teaching innovation in the faculty reward system:* Low=3.18(2.42), High=5.03(2.17)

The ratings of importance of teaching quality and innovation were subjected to analysis of variance. The inter-institutional differences in ratings of importance to the responders' colleagues, department heads, deans, and top university administrators were all significant at the .01 level.

Rank Differences

Several differences in responses of assistant professors (N=101), associate professors (N=164), and full professors (N=212) were noted. (Statistical analyses of these results have not yet been performed.) Assistant professors

- were more likely than associate or full professors to use brief group activities in their classes (asst–68%, assoc–59%, full–52%) and to use the World Wide Web to provide information to students (asst–76%, assoc–62%, full–58%).
- were equally likely as associate professors and more likely than full professors to use group activities lasting most of a class period (asst–44%, assoc–45%, full–34%).
- were just as likely as associate and full professors to assign required team homework (asst–44%, assoc–43%, full–47%).
- gave comparable or slightly lower ratings of the importance of teaching quality to themselves (asst–9.13, assoc–9.28, full–9.26) and to their institutions' top administrators (asst–7.08, assoc–6.95, full–7.03), lower ratings to their colleagues (asst–7.03, assoc–7.28, full–7.55), and similar or lower ratings to their department heads (asst–7.57, assoc–7.49, full–7.87) and deans (asst–6.78, assoc–6.87, full–7.22).
- rated the importance of teaching quality and innovation in the faculty reward system comparably to the associate professors and well below the full professors (quality: asst–4.55, assoc–4.55, full–4.94), (innovation: asst–4.16, assoc–4.31, full–4.71).

Sex differences

Relative to men (N=450), women (N=53)

- were more likely to have attended a teaching seminar (W–24%, M–14%, $p<.05$), to use brief in-class group activities (W–76%, M–57%, $p<.05$), to use group activities lasting most of a class period (W–57%, M-39%, $p<.05$), and to use the World Wide Web to provide information to students (W–78%, M–62%). They were equally likely to assign required team homework (45% of men and women).
- gave comparable ratings to the importance of teaching quality to themselves (W–9.26, M–9.28) and to their institutions' top administrators (W–6.98, M–7.05), and lower ratings to their colleagues (W–6.64, M–7.40), department heads (W–7.26, M–7.78), and deans (W–

6.46, M–7.10). The sex difference in ratings given to colleagues was significant at the .005 level.
- gave lower ratings to the importance of teaching quality (W–4.56, M–4.77) and innovation (W–4.30, M–4.55) in the faculty reward system.

Summary and Discussion

The survey indicates a moderate level of involvement of the responders in attending teaching seminars and implementing nontraditional teaching practices: using team activities in and out of class, giving writing assignments, and using email and the World Wide Web as sources of information, among other methods. (We would speculate that these levels represent considerable gains over the five years that have elapsed since the SUCCEED Coalition was formed, but a survey was unfortunately not conducted at that time.) The responders also believe that teaching is more important to them than it is to their colleagues and administrators, and that it counts for relatively little in the faculty incentive and reward system.

The responses vary noticeably from one institution to another, from one academic rank to another, and between male and female responders. For example, the percentages of responders giving required team assignments vary from a low of 35% at one institution to a high of 72% at another, and the ratings of importance attached by administrators to teaching varied from one institution to another by almost two points on a 10-point scale. Assistant professors are more likely than associate or full professors and female professors are more likely than male professors to use in-class group activities and the World Wide Web in their teaching, and the assistant professors and female professors are more likely to believe that teaching is devalued in the faculty reward system.

While these results are interesting, they must be viewed with a measure of caution. Although the overall response rate of 35% is considered quite high in survey-based research, in all likelihood the responders are not truly representative of the total faculty population. The responders' student evaluations are well above the average ratings for their departments; professors who place a high priority on teaching are more likely to respond to a survey on teaching practices than are professors who place a higher priority on research; and professors who perceive that teaching is devalued on their campus might be more likely to respond than professors who are satisfied with the faculty reward system.

This survey is the first step in assessing the impact of coalition efforts on the climate for teaching at the eight SUCCEED campuses. The true significance of the results will only be known once similar data are obtained two and four years from now. We look forward to reporting these data at future conferences.