2006-2066: SHORT AND LONG-TERM INFLUENCE OF EXCELLENT INSTRUCTORS ON GRADUATES IN ENGINEERING TECHNOLOGY: A CASE STUDY

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Short and Long-term Influence of Excellent Instructors on Graduates in Engineering Technology: a Case Study

Abstract

A survey asked engineering technology (ET) faculty at the University of Pittsburgh at Johnstown (UPJ) to recall the instructor they feel had the most influence on their career/life and indicate the qualities possessed by the instructor and the reasons the instructor was able to so greatly influence them. The objective of the survey is to better understand the long term influence professors can have on their students. In addition, a case study of an excellent instructor is presented. A survey was conducted to solicit opinions on this instructor from graduates of the ET program. Numerous former students have emphasized the significant influence this instructor has had on not only their careers, but also in other aspects of their lives. Results of the survey are summarized and presented. The paper provides ideas for faculty members looking for ways to have significant positive impact on their students that lasts well beyond their college years.

Introduction

College instructors differ in their teaching styles and motivating abilities. Many instructors influence students' learning and attitudes during their college years and as they begin their careers (short-term). Some instructors, however, are able to have long term influence on their graduates' careers and lives that extends well beyond their college experience and initial career choices. When graduates look back at their educational experiences during college, they can usually identify one or more instructors who they view as having significant influence on their lives since college. But describing the unique characteristics of those instructors and how they impacted the professional lives of graduates might be a harder task.

Traditionally, effective teaching has been linked to the long and lasting positive impact of instructors. Three (3) distinct areas were identified as necessary for being "effective" as a professor "Character", "Competence" and "Connection." Character involves the personal traits of the professor. Character is manifested in the form of the students feeling very motivated, confident and comfortable with the integrity of the classroom experience and the professor. "Competence", manifested itself in the form of the professor's ability to convey the technical content of the material in a way easily understood by the students. The "Connection" category represents the "soft" attributes of the effective professor because they do not deal directly with the professor's knowledge or ability to convey the material to the students. Rather, "Connection" involves a variety of personal "contact" opportunities, both inside and outside the classroom, which can occur if both the students and professor are open to them. Essentially, "Connection" is relationship oriented invoking a mutual trust, respect, and reverence between human beings.[1]

Overall competence of the faculty has been listed as a key criterion for engineering and engineering technology programs interested in getting their academic programs accredited. The faculty must be capable of providing students an appropriate breadth of perspective and effective instruction in the use of modern technical and nontechnical methodologies in careers appropriate to the program objectives.[2]

From a student learning perspective, Lowman's research and other studies[3, 4] identified a "two-dimensional model" of good teaching. The first and the most important is intellectual excitement, which includes organization and clarity of presentation of up-to-date material. The second dimension identified is interpersonal rapport. This includes showing interest in students as individuals, encouraging them to think independently, and being warm, open, predictable, and student-oriented.

ET Faculty Survey

A questionnaire was administered to solicit opinions from ET faculty to recall the instructor they feel had the most influence on their career/life and indicate the qualities possessed by the instructor and the reasons the instructor was able to so greatly influence them. The questionnaire consisted of six questions. Thirteen responses from members of the ET faculty were received. The first question asked the ET faculty "When did you have that excellent instructor?" Figure 1 shows that most ET faculty recalled having their best instructor during their undergraduate studies. One instructor indicated that his excellent instructor taught him during high school.

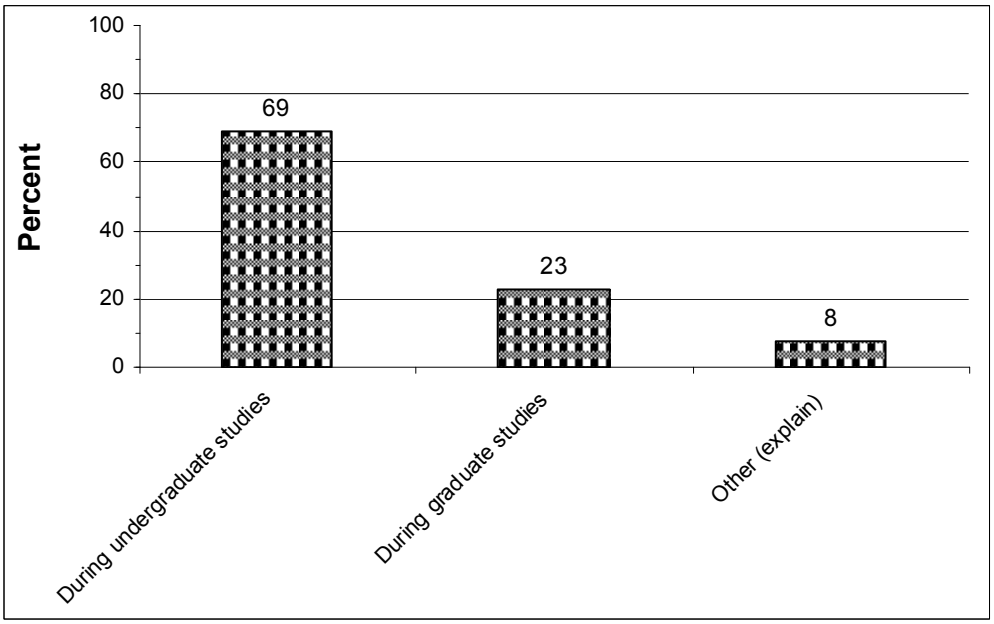

Figure 1: Period when ET faculty had excellent instructors.

The second question asked the ET faculty "What was your academic level when you had that excellent instructor?" Figure 2 indicates that an excellent instructor can leave a long and lasting impact on his/her students at any stage of their academic level. In other words, the academic level appears to be irrelevant except for the senior year which was not selected by any faculty member in the survey. In addition, there are more excellent instructor cases indicated in the sophomore year than any other year. Perhaps in the sophomore year, students mature a little bit and start having a better feel for their academic and career choices while in their senior year they are relatively more established in terms of their career and life directions. There is also evidence that excellent instructors can significantly influence their students' careers/lives even as late as their graduate studies.

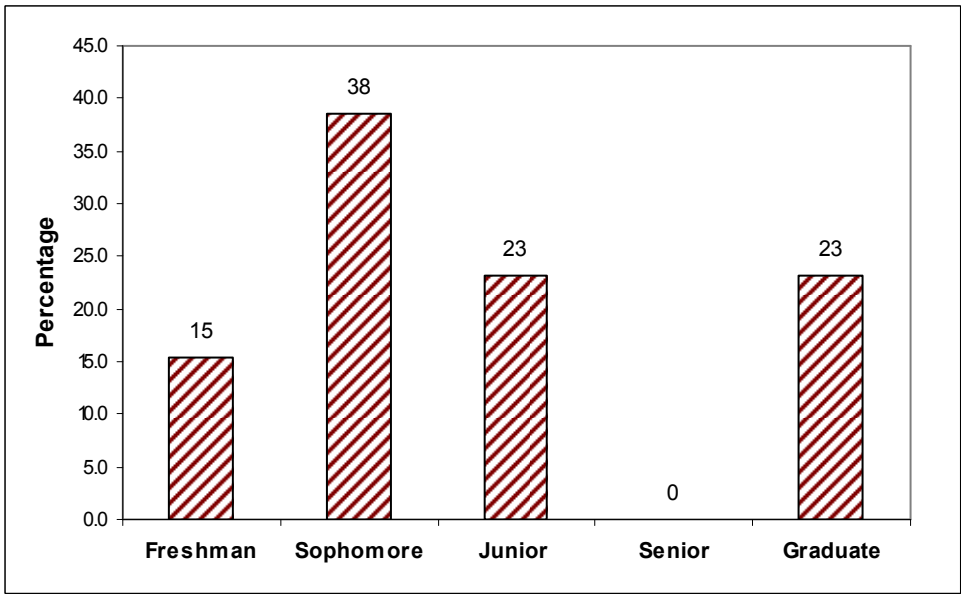

Figure 2: Academic level when ET faculty had excellent instructors.

When excellent instructors are sorted by rank, the majority are tenured associate or full professors as shown in Figure 3. It makes sense that the experience instructors gain over the years helps in shaping their abilities to significantly influence their students in a positive way. However, it should be noted that most institutions have a greater percentage of tenured faculty than untenured faculty, so it is expected that more excellent instructors would come from academic ranks containing larger populations. In addition, the results for this and other questions may not be necessarily generalized to all institutions because of the limited population in the survey and only faculty at one institution being surveyed.

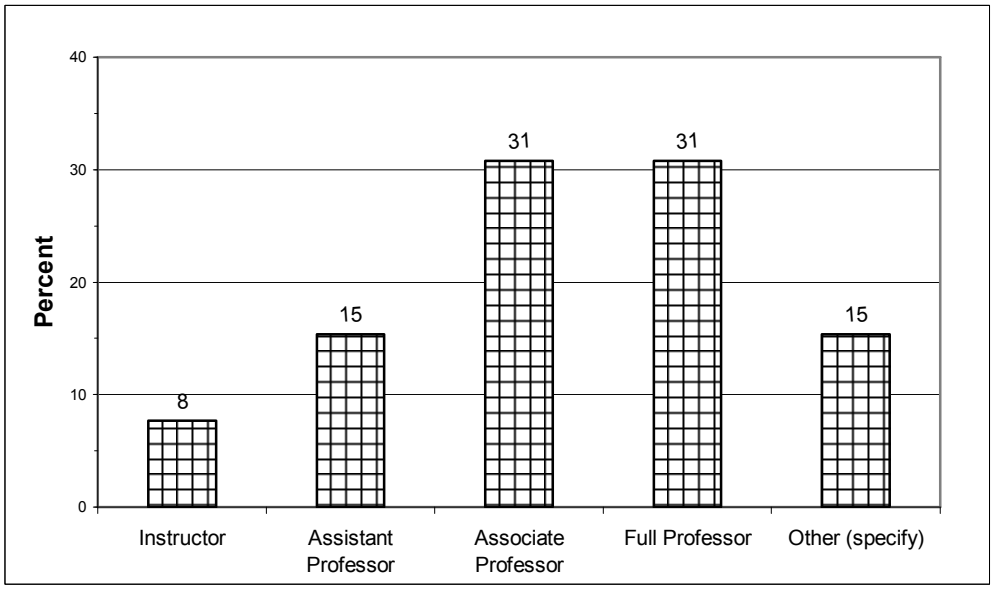

Figure 3: Rank of excellent professors.

The fourth question asked the ET faculty to identify the qualities possessed by the excellent instructor that greatly influenced them. A list of possible qualities was given and ET faculty members were asked to check all that apply as well identifying new qualities if needed. Table 1 gives the list of excellent instructor qualities identified along with the number of selections out of a maximum of 13 selections. The percentage of selection is also given.

Table 1: Qualities of excellent instructor identified by ET faculty

Excellent Instructor Quality	**Number of Times Checked**	**Percentage of Max selection**
His/ her effective teaching methods	12	92
His/her enthusiasm in class	11	85
The way he/she treated students in class	6	46
The way he/she treated students outside class	2	15
His/her concern of student learning	6	46
Grading system and fairness	6	46
His/her interaction with students	5	38
He/she acted as a mentor to students	3	23
He/she practical and showed you the end of the tunnel	4	31
His/her sense of humor	6	46
His/her political views	1	8
His/her wisdom and vision	5	38
His/her strong leadership qualities	2	15
His/her confidence in his/her knowledge and views	12	92
His/her ability to motivate students	5	38
His/her academic advising	0	0
His/her ability to act as a role model to students	3	23
His/her ethics and professional integrity	6	46
His/her professional experience	2	15

As indicated in Table 1, most responses indicated that effective teaching methods, enthusiasm, and instructor's confidence in his/her knowledge and views are the qualities of an excellent instructor they had as in the past as students. Almost half of the responses indicated that other qualities of an instructor make him/her an excellent instructor including the way he/she treated students in class, his/her concern of student learning, grading system and fairness, his/her sense of humor, and his/her ethics and professional integrity. About a third of the survey indicated instructor's interaction with students, his/her practicality (showing students the end of the tunnel), his/her wisdom and vision, and his/her ability to motivate students are also qualities associated with the best instructors they had. A small percentage of the survey responses gave little or no weight to other excellent instructor qualities not mentioned such as the way the instructor treat students outside class, the instructor acting as a mentor to students, his/her political views, his/her strong leadership qualities, his/her academic advising, his/her ability to act as a role model to students, his/her professional experience.

The fifth question in the survey asked the ET faculty members to recall the areas in their lives that have been affected by the excellent instructor they had in their college years. Figure 4 gives a breakdown of the different areas in the lives of faculty members indicated to have been influenced by excellent instructors they had. The vast majority of responses indicated "*technical skills and professional performance*" to be one area the excellent instructor has positively influenced. It should be noted that most ET faculty had considerable industrial experience before working as professors in academic environments. About half of the responses indicated the area "*Exam Taking Skills*" was significantly affected by the excellent instructor in a positive way. This is interesting because it indicates that the excellent instructor influenced the performance of students while at school either during their undergraduate or graduate studies. Other areas affected by excellent instructors that were checked by more than a third of the responses include "*presentation skills"* and *"ability to plan and execute tasks,"* both of which are skills essential for success as a student and as a professional. Few responses checked other areas in their lives influenced by excellent instructors. Such areas are a mix of personal and professional skills as shown in Figure 4.

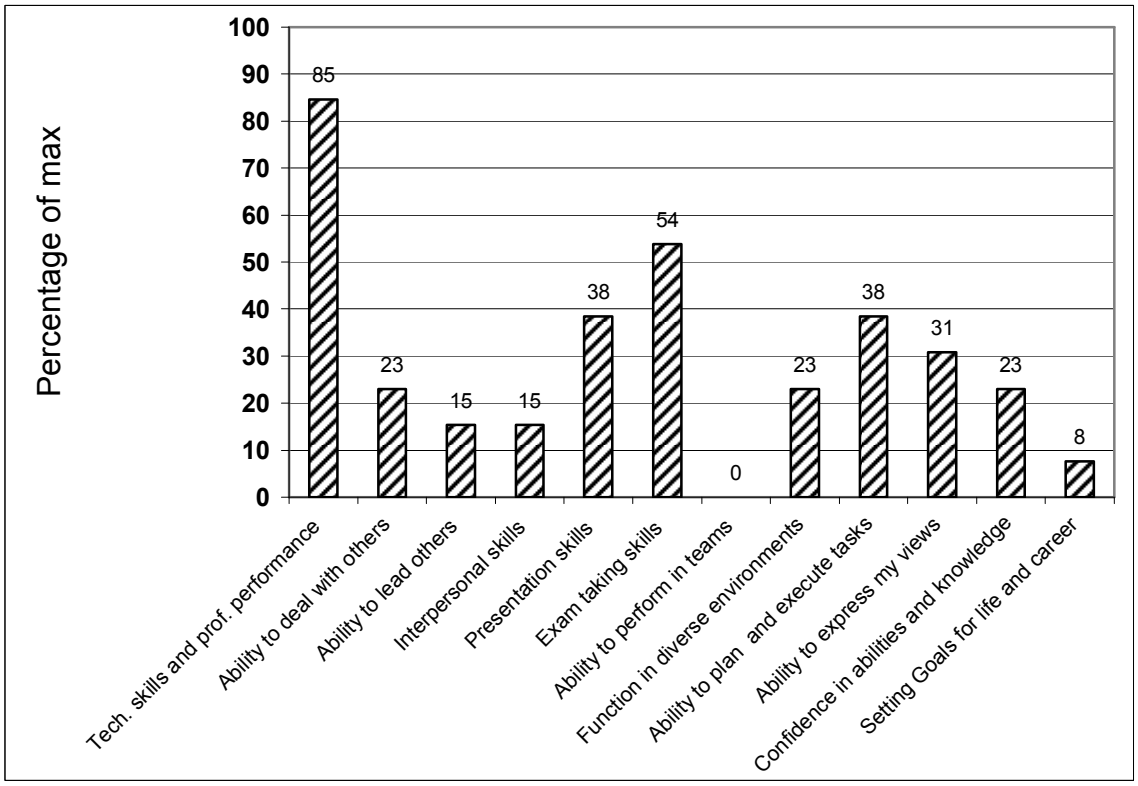

Figure 4: Areas affected by excellent professors.

The last question asked the faculty to add any comment they wish regarding their favorite excellent professor. Following are excerpts from the comments made by the faculty:

- "*He is one of the main reasons why I loved teaching and decided to became a professor*"
- "*Gave view of the big picture of life*"
- *"Tied lessons back to real life experience with sense of humor"*
- *"Kept perspective of school as introduction a career"*

- "*Stressed competitive nature of success in school as related to opportunities for employment"*
- "*Knew so much about so many issues in life"*
- "*Encouraged critical thinking and made you recognize that today's answer may well be supplanted in the future by new knowledge and/or understanding"*
- *"Discipline approach to problem solving-examine the situation; make objective decisions regarding the factuality, significance, and applicability of the data/information; determine the underlying scientific/engineering principles; and then apply them to determine an appropriate and meaningful solution to the problems"*
- "*Treated students fairly, openly, and honestly"*
- "*Deep subject knowledge and able to present that knowledge in a variety of ways"*
- *"Inspired students….learned from him that we are all human and cannot control everything around us or in us"*
- *"Learned from him that family is more important than anything else"*
- *"Showed me that a methodical, organized approach to any problem yielded results "*
- *"Was able to explain what they wanted students to learn"*
- *"His lectures were stimulating and humorous and his insights about life and other issues influenced my views about a variety of things at a time in my life where I was developing my own identity"*
- *"One of his words of advice was to plan to have three careers in your life- I believe this is important to realizing one's full potential and will help keep a person challenged as they age, grow and change during their lifetime"*
- *"Helped me develop a strong appreciation for literature, the outdoors/nature and arts and humanities-things that make life worthwhile"*
- *"He was a strong role model, taught well, and nurtured us through a number of courses including labs"*
- *"He applied his engineering capabilities to social issues"*

Student Survey

As a case study of an excellent instructor, another survey was conducted to solicit opinions on an instructor from graduates of the ET program. This instructor is a professor in the ET division at UPJ. He has won the university award for Teaching Excellence and has a reputation as an excellent instructor. Thirty one (31) former students have emphasized the significant influence this instructor has had on not only their careers, but also in other aspects of their lives. The survey took an open format and asked the ET gradates to express their opinions of this instructor in terms of the qualities they felt he possessed and how he influenced their careers/lives. The qualities of this instructor from the survey can be categorized in two groups: teaching qualities and personal qualities. Tables 2 and 3 list a summary of the qualities indicated in the student survey.

Table 2: Teaching qualities of excellent instructor identified by former students

Teaching Qualities
Challenging but fair
Captivating teaching style
Discussed world issues (current events) in class that were important to students as persons and as engineers
Very disciplined – ran his classes firm, fair and respectfully
Had full command of material and really wanted students to learn
Effectively combined textbook theory and examples with real applications
Interaction with students – unique and positive
Personal attention with drill – like attitude to get most out of student and challenge each student Teaching methods geared toward achieving total student understanding
Using groups/teams – taught students how to cooperate
Taught every class with a positive view and treated each student with same respect and individuality
He possesses highly motivated thinking
Always interested that students understood material before moving on
Teaching presentations – you could not help but be attentive and interested in what was being presented
Teaching could convey underlying principles of a subject and also instill a practical sense of its application
Cared about not only how material was presented, but how the students received and understood that information
Teaching based on a "real life approach"

The survey also included other comments that relate to qualities of this instructor and his influence on their careers/lives:

- Students respect instructor for not only knowledge but knowing he cares about their future
- Students remember his advice (catch phrases)
    - Don't sweat the small stuff, and it's all small stuff [5]
    - Choose a job you love and you will never work another day in your life
    - Someone will handle the crisis, so why not you
- Only professor to give me a failing grade – but my performance warranted a failing grade and this helped me turn around and achieve better in future courses
- Much of the advice and encouragement he conveyed helped formulate many of the decisions I've made throughout my lifetime. His efforts as a teacher have made a permanent imprint on my life
- He let us know, through his support, that we were capable of becoming competent engineers, regardless of gender
- Instilled the belief that if we thought we were capable of success, then success was attainable
- I admire his leadership and organizational skills, and compassion for students

- Always concerned with students on a personal level, as well as on a professor/student level
- One of most caring individuals encountered in career
- Teaching and learning based on "your own personal initiative
- The grade you receive is directly proportional to how much work YOU do. This philosophy "weeds out" the unmotivated – don't waste your money, time and professor's time if you really don't want to be there
- Acts as a "coach", encouraging students to work in teams and not always rely on professor for answers
- Gets students to realize that if they don't speak up when they have a problem, then the only person they can blame is themselves
- No hand-holding, students must work hard to understand material and result is they retain information better
- Excellent interaction with students – always felt comfortable going to him if there was a problem
- Provided students with many required skills and a positive attitude towards life
- Asked students to look deep into own character and to evaluate their personal and leadership characteristics

Table 3: Personal qualities of excellent instructor identified by former students

Personal Qualities
Genuine interest in students
Uses words of encouragement. He encouraged each and every one of his students
Not too proud to admit mistakes
Leads by example
Had both technical and personal influence
Taught students: • Have concern for others • Ethics both in engineering and in general • Respect for self • Discipline
Took time to advise students in trouble giving advice and direction to help students get back on track – Available for personal advice
Showed his effectiveness, versatility and ability to teach while overcoming adversity: • Illness of son and Gulf War "stand-by" status
Showed that he can be an effective teacher and advisor while more important issues weighed heavily on his shoulders
Stressed importance for people to take responsibility for their actions
Very intelligent and disciplined individual, but also fair minded and approachable
Mentor to his students and he took great pride in his work and the development of his students
Never ending enthusiasm
Provided a great deal of guidance and encouragement

Advice for Engineering Educators

The survey suggests that a faculty member is likely to have significant short and long-term positive influence on students and graduates by acquiring as many of those qualities listed in Tables 2 and 3 as possible. An engineering educator aspiring to become an instructor who has both short and long-term positive influence on students can achieve that goal by recalling their own experiences with excellent instructors and by working to develop the professional and personal qualities listed in Tables 2 and 3. The comments made by graduates about a specific example of an excellent instructor also provide insight into what students recall most about an instructor's influence on them.

To work toward becoming an excellent instructor, engineering educators should focus their efforts on developing a few qualities at a time, so as to not become overwhelmed. For example, one may first need to focus on developing technical competency and self-confidence in one's knowledge since this is recognized as a key to good teaching[6] and is usually easily achieved through one's academic training. Simultaneously, educators may work at developing good rapport with students, since this generally results in good teaching evaluations necessary to promotion and tenure.[7] Just as educators benefit by getting to know their students by developing good rapport, educators who let students learn about who they are and their background develop mutual trust between themselves and their students.[8] Once several qualities have become well developed, a few new qualities can be focused on. In developing the various qualities, attendance at conferences such as ASEE[9] and FIE[10] and teaching workshops such as ASCE's ExCEEd[6] and ASME's Essential Teaching Seminars,[11] as well as review of conference proceedings[12, 13] and magazine articles, such as in ASEE's *Prism*[14] which are devoted to improved teaching, can be a resource for engineering educators wishing to develop into excellent instructors. Becoming an excellent instructor is a gradual process that requires planning and determination, but can be very rewarding for those who truly wish to have long-term positive influence on their students and the future of the engineering profession.

Conclusions

Excellent instructors who have significant positive impact on their students that lasts well beyond their college years appear to possess unique qualities at both the professional and personal levels. According to the results of an ET faculty survey, an excellent instructor is likely to be an associate or full professor teaching at the undergraduate level. The excellent instructor will mostly leave a lasting impact on the sophomore and junior classes. Specific qualities of an excellent instructor as identified by most surveyed faculty members include effective teaching methods, enthusiasm, and instructor's confidence in his/her knowledge. In addition, a significant number of responses indicated that other qualities will also characterize an excellent instructor such as the way he/she treated students in class, his/her concern for student learning, grading system and fairness, his/her sense of humor, and his/her ethics and professional integrity.

Most surveyed faculty members agreed that the areas in students' lives that are likely to be affected by excellent instructors include "*technical skills and professional performance*" and "*exam taking skills*" Other areas affected by excellent instructors that were indicated include "*presentation skills"* and *"ability to plan and execute tasks,"* both of which are skills essential

for success as a student and as a professional. The case study of an excellent instructor confirmed the results of the faculty survey. Students identified a number of teaching and personal qualities of that excellent instructor, consistent with those identified by the faculty. Once again, an instructor could only be viewed as excellent by his/her students if he/she teaches effectively with passion and if he/she genuinely shows a personal compassion for students.

Bibliography

1. Martinazzi, R., and Samples, J. "Characteristics and Traits of an Effective Professor" Proceedings, 30th ASEE/IEEE Frontiers in Education Conference, Kansas City, MO, 2001.
2. Accreditation Board for Engineering and Technology (ABET), "Criteria for Accrediting Engineering Technology Programs: Effective for Evaluations During the 2006-2007 Accreditation Cycle," Baltimore, MD. , November 2005.
3. Lowman. J., (1985). Mastering the Techniques of Teaching, Jossey-Bass, San Francisco, CA.
4. Mehta S, and Danielson J. "The Scholarship of Teaching: Building a Foundation before Reaching the Pinnacle." Proceedings of the American Society for Engineering Education Annual Conference & Exposition, Albuquerque, New Mexico, 2001.
5. Carlson. R., (1997). Don't Sweat the Small Stuff, and It's All Small Stuff, HYPERION, New York.
6. ASCE ExCEEd Teaching Workshop, American Society of Civil Engineers, URL: http://www.asce.org/exceed/, accessed March 6, 2006.
7. Rose, A.T. "Building Better Rapport with Students: Advice for New Engineering Educators." Proceedings, 2002 ASEE Annual Conference & Exposition, Montreal, 2002.
8. Murad, M, Martinazzi, R. and Samples, J. "Mentoring New Faculty: A Student Exercise Designed to Enhance Student-Faculty Relationships." Proceedings, 2002 ASEE Annual Conference & Exposition, Montreal, 2002.
9. ASEE Annual Conference and Exposition, American Society for Engineering Education, URL: http://www.asee.org/about/events/conferences/index.cfm, accessed March 6, 2006.
10. 2006 FIE Annual Conference, Frontiers in Education Conferences, URL: http://www.fie-conference.org/, accessed March 6, 2006.
11. ASME Essential Teaching Seminars, American Society of Mechanical Engineeris, URL: http://www.asme.org/Education/College/Essential_Teaching_Seminars.cfm, accessed March 6, 2006.
12. ASEE Conference Proceedings Search 1996-2005, American Society for Engineering Education, URL: http://www.asee.org/about/events/conferences/search.cfm, accessed March 6, 2006.
13. Frontiers in Education Clearinghouse, URL: http://fie.engrng.pitt.edu/, accessed March 6, 2006.
14. ASEE *Prism*, American Society for Engineering Education, URL: http://www.asee.org/about/publications/prism/index.cfm, accessed March 6, 2006.