Mentoring Engineering Graduate Students in Professional Communications: An Interdisciplinary Workshop Approach

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Abstract

Developing the engineering graduate student's professional communications abilities is a critical element in the mentoring process. Excellence in communications is required for success in both academic and research engineering, yet helping graduate students acquire the necessary skills can be one of the most challenging tasks for the student's mentor or research director. Many engineering graduate students have had little instruction or practice in writing and communicating as professionals. In addition, those whose first language is not English often need specialized instruction in writing and presenting in English.

This paper describes a series of four collaborative professional communications workshops for engineering graduate students at the University of South Carolina College of Engineering and Information Technology. Each of the workshops focused on a major communications responsibility in engineering at the advanced degree level: teaching, dissertation writing, scholarly publication, and career-related communications. Each session included brief, informal presentations by engineering and communications faculty on communications principles, followed by discipline-specific small group activities for practice and discussion.

Evaluations showed that graduate students found the workshops helpful. The workshops also increased dialogue among communications and engineering faculty on ways to strengthen the professional communications abilities of graduate students.

This presentation includes a description and handouts on each of the four workshops, a discussion of current pedagogical theories pertinent to each topic, and suggestions for implementing the model in other institutions.

Introduction

Transforming engineering graduate students into professors and leading researchers includes developing the communications abilities of these future professionals. The ability to write and speak with a high level of competence is essential for professional careers in academia or research. Even though ABET Engineering Criteria 2000 has encouraged engineering colleges to expand communications instruction in the undergraduate curriculum, it has long been possible to complete an undergraduate engineering program with no formal writing instruction beyond freshman composition

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(1, p. 130). Thus, many engineering graduate students could profit from a review of communications principles and an introduction to effective professional communications. Unfortunately, the attention to communications in graduate schools is often narrowly focused on the thesis or dissertation, along with related articles and conference papers. Dissertation and research directors spend considerable time reading and critiquing the students' work; graduate students spend considerable time trying to write and revise papers to meet their directors' expectations. Unfortunately, this process does not always produce the desired results.

According to the Boyer Commission on Educating Undergraduates in the Research University, "Nowhere are the failures of graduate education more serious than in the skills of communication" (2, p. 30). No doubt, many graduate directors have reached the same conclusion, especially when slogging through a student's impenetrable prose to find the brilliant research submerged beneath it. Yet even though they may be concerned about poor communications skills among the general graduate student population, individual engineering professors seldom have the resources to improve the situation.

When engineering students at the University of South Carolina have problems writing a thesis or dissertation, the faculty advisors often refer them to the Professional Communications Center (PCC), a professionally staffed engineering writing and communications center established in 1998 within the College of Engineering and Information Technology. The PCC, which evolved from an electrical and computer engineering (ECE) Writing Center established several years earlier with support from the Gateway Coalition, was created primarily to serve engineering undergraduates. The PCC, like the earlier ECE Writing Center, integrates communications instruction into undergraduate lab courses and provides resources for undergraduate engineering students, engineering faculty, and engineering teaching assistants (3).

The close working relationship among the communications consultants, the engineering teaching assistants, and engineering faculty gradually generated requests for PCC consultation to graduate students, including advice on thesis writing. While consultation from the PCC's communications specialists helps M.S. and Ph.D. candidates complete an acceptable thesis or dissertation, this individualized instruction comes late in the student's graduate work. Many graduate students need earlier, more general instruction to help them write sound proposals, prepare papers, and begin the dissertation process on time. This instruction should help graduate students apply general principles of academic and career communications to the specific requirements of their engineering discipline. . Ideally, the instruction will include input from both engineering and communications faculty.

At the University of South Carolina, engineering professors and PCC communications specialists developed an approach to orient graduate students to academic and professional communications without requiring major investments of time from faculty or students. In the 2000-2001 academic year, the engineering and communications faculty collaborated in teaching a series of four workshops to give practical advice on the communications topics of greatest concern to graduate students: communications in

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teaching, writing the thesis or dissertation, writing for publication, and career-related writing. The sequence of topics was designed to fit the typical timelines in graduate work, with teaching concerns addressed in August, thesis planning in October, publications in March, and career concerns in April. Each of the 90-minute workshops briefly introduced key principles of communications related to the topic, followed by one or more informal presentations by individual faculty members who had relevant experience and particular interest in the topic. Generally, the workshops concluded with hands-on practice and roundtable discussions among the graduate students.

Attendance at the workshops, which was voluntary, averaged 25 graduate students, but each of the topics attracted a slightly different group of students. In fall 2000, graduate enrollment in the USC College of Engineering and Information Technology totaled 535 students, including 109 distance education (APOGEE) students and approximately 90 part-time students. Graduate degrees awarded in 2001 included 144 MS and ME degrees and 17 Ph.D.'s. Thus, the graduate student participation in the workshops indicates a level of interest that justifies offering these learning opportunities.

This paper describes the process for organizing the workshops, as well as the objectives and approaches used for each topic. It also outlines the key principles and content introduced in each workshop and reports the graduate students' evaluations of the sessions.

Workshop on communications and teaching

At the USC College of Engineering and Information Technology, as in other engineering colleges, engineering graduate students participate in undergraduate education in a variety of ways. Many of the graduate students are teaching assistants assigned to undergraduate laboratories where they instruct students on conducting experiments, oversee the lab work, answer students' questions, check engineering notebooks, and review or grade lab reports. In some departments or courses, the TAs have less responsibility; in some cases, an experienced graduate student may teach a lab course under minimal supervision by engineering faculty. Regardless of their particular assignments, teaching assistants have a significant role in the educational mission of the institution.

Because teaching assistants have an impact on the quality of undergraduate research and instruction, engineering educators, like their counterparts in other disciplines, have stressed the need to educate graduate students as apprentice teachers. Indeed, the Boyer Commission on Educating Undergraduates in the Research University states that needed changes in undergraduate education cannot occur unless graduate education is changed first (2, p. 29). The Commission notes that "graduate courses need particular emphasis on writing and speaking to aid teaching assistants in their preparation for teaching as well as research functions" (2, p. 31).

Unquestionably, theory and practice of communications should be integrated into the educational experience for all engineering graduate students. However, incorporating

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communications emphases into existing graduate courses may not be the most effective method for preparing graduate TAs to help undergraduates write better reports and make better presentations. Teaching assistants need practical suggestions and mentoring from the beginning of their first TA assignment through every semester of their appointments. They also need instruction that addresses their unique role and status in undergraduate education, that of near peer.

The engineering teaching assistant is a role model –sometimes positive, sometimes not—for undergraduates. The graduate student TA has attained the goal that the undergraduate aspires to and perhaps views as exceedingly difficult to achieve. The TA is also likely to be nearly the same age as the undergraduate; the TAs' near-peer status may make them seem more approachable than a senior faculty member. The near-peer, as Lave points out, "facilitates the sharing of knowledgeable skills" (4, p. 81). The more experienced student is exceptionally influential in helping novices understand what is expected within the academic community and in developing the skills needed to meet those expectations.

Because teaching assistants are a vital part of the undergraduate learning experience, the first graduate student workshop in the 2000-2001 series developed by the USC College of Engineering and Information Technology focused on communications and teaching. In previous years, the ECE Writing Center and PCC staff had conducted TA workshops on teaching communications in lab courses, which included lectures and discussions on giving writing assignments, responding to student writing, and grading papers (3). This earlier lecture-based approach was discarded in favor of a more interactive, collegial format. An outline of the workshop on communications appears below.

Outline - Communications and Teaching Workshop
August 2000

Welcome and Introductions
"Teacher Preparation as Professional Development for Engineering Graduate Students' Professional Development" (10 minutes)
    Speaker: Interim Chair, Dept of Electrical Engineering
"Communications and Teaching" (10 minutes)
    Speaker: Director, Professional Communications Center
"Oral Communications – Some Principles and Tips for Giving Instructions"
    Discussion and exercise led by PCC staff (30 minutes)
"Written Communications – Some Principles and Tips for Commenting on Students' Papers"
    Discussion and Paper Grading Exercise led by PCC staff and experienced TAs in each discipline (30 minutes)

By design, the first workshop of the year began by focusing on the participants and their important role in the college. The group of experienced and beginning teaching assistants were asked to introduce themselves, and to describe their TA positions and their expectations for the workshop. This opening exercise helps build identification among TAs from various departments and aids new TAs in identifying experienced colleagues who can give advice and information in the future.

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As with all four workshops, the first presentation in the session on communications and teaching was an informal talk by an engineering faculty member. The informality is purposeful. First, it reduces the preparation time for faculty members. Second, the informal talk represents a form of mentoring as experienced professionals draw on some of their personal experiences to advise the professionals in training. In this particular workshop, the keynote faculty speaker was the Interim Chair of the Electrical Engineering Department, who spoke on teacher preparation as professional development. Although many doctoral level engineering teaching assistants will pursue academic careers and thus recognize the value of their TA experience, those planning non-academic careers may see the teaching assistantship primarily as a job. Both groups benefit from reflecting on the connections between teaching strategies and management skills, as well as on the importance of communications throughout the engineering profession. In almost any professional position, engineers will be teachers of communication, assigning writing and communications tasks to members of project teams or employees, evaluating drafts, and suggesting revisions or edits.

The engineering professor's observations on communication and teaching were followed by comments from the PCC director on the same topic. Their dialogue provided the graduate students a first-hand glimpse at how engineering and communications professionals talk about writing and speaking. This informal, authentic dialogue among professionals from two disciplines gave graduate students an insider's view of the real problems and critical importance of communications in achieving one's professional goals. Developing an insider's perspective of communications is part of the transition students must make in order to begin speaking and writing as professionals.

The remainder of the workshop consisted of two practical exercises related to oral and written communications in teaching. For each exercise, the graduate students assembled into small, discipline-specific groups led by an experienced TA in that department and by communications consultants from the Professional Communications Center. The session on oral communications described principles of spoken communication in the classroom and laboratory, such as focusing on goals, using repetition, exercising patience, listening carefully, and staying on task. An oral instructions exercise, adapted from Pfeiffer and Jones (5, pp. 13-17) was used to illustrate the difficulty of giving and following directions. For this activity, the group leader was given a drawing composed of five adjacent, but randomly arranged squares. The leader was then asked to instruct the group members in drawing the identical picture; however, no gestures or visual cues could be used. From this activity, participants experience first-hand the difficulties of instructing others and following instructions when the outcome is unfamiliar.

The exercise on paper grading began with an overview of purposes of grading and commenting, and a brief review of research that shows the most effective commenting consists of three or four marginal notes and an endnote. Students were then given a student lab report to comment on and to grade. A group discussion led by an experienced TA made students aware of the need to establish and use grading criteria, to set goals for comments on each set of reports, and to set reasonable limits for the time spent commenting on each paper.

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Written evaluations of the workshop showed that the graduate students found the practical tips and exercises especially valuable. New TAs commented that the workshop gave a good overview of "what teaching involves" and "how to behave in the lab with students." One added that "the workshop cleared up a lot of concepts regarding teaching, also it highlighted the common mistakes made." Some of the new TAs also expressed a desire for more presentations by experienced TAs, more input from professors into the small group discussions, and more discussion of class management and problem solving. Input from the participants at this workshop, especially the emphasis on advice from experienced peers and near peers, guided the planning of subsequent offerings.

Workshop on thesis and dissertation writing

In the USC College of Engineering and Information Technology, as in most universities, there is no formal thesis/dissertation course or mentoring system. Students' experience varies considerably both in quality and quality of instruction and depends primarily upon the individual director. The USC Graduate School offers dissertation workshops a few times a year; however, the space is limited, the information is not discipline specific, and few engineering students attend.

The unstated assumption in graduate education seems to be that by the time students reach the dissertation stage, they should already know how to manage and complete the project; unfortunately, most students have never undertaken a project of this magnitude and are not sure how to transfer their previously-mastered skills to such a task. Thus, the focus of the workshop became the process behind a long, messy project such as a dissertation. Shifting the students' attention from the dissertation as a product to the dissertation as a process and showing that writing fits into the research itself became a primary objective for the workshop.

In addition, the workshop provided an opportunity to strengthen the graduate community by emphasizing the social nature of research, writing, and knowledge, and by building a support network and mentoring system for the students as they progressed through their dissertations into their careers. In spite of the popular image of engineering scholars as introverts, student surveys from the workshops showed that the engineering graduate students welcomed a chance to talk with colleagues about the challenges of graduate work. A common comment on workshop evaluations was the relief in finding that other students were going through the same struggles. It is precisely this kind of communal attitude that aids in successful completion of the dissertation by building student confidence and support systems. An overview of the workshop on dissertation writing is shown below.

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Outline - Dissertation Writing Workshop
October 2000

Welcome and Introductions
"The Importance of Writing in Engineering" (10 minutes)
Speaker: Graduate Director, Dept. of Mechanical Engineering
"Similarities Between Writing a Thesis/Dissertation and Writing Major Research Proposals and Reports" (10 minutes)
Speaker: Professor of Electrical Engineering
"The Ethical Dimensions of Writing and Talking About Research" (10 minutes)
Speaker: Coordinator of the Engineering Ethics Program
"Incubating Ideas"
Discussion and exercise led by PCC staff (15 minutes)
"Coherence in Writing" (15 minutes)
Discussion and exercise led by PCC staff
"Managing and Surviving the Dissertation Process" (30 minutes)
Discipline-specific, peer-led discussion

Two engineering faculty members participated in the workshop. A professor of electrical engineering discussed the similarities between writing the dissertation and writing major research proposals and reports, and the graduate director of mechanical engineering spoke about the importance of writing in general and gave suggestions for ways non-native speakers can improve their writing. Both professors worked to demystify writing the dissertation by comparing it to the writing students have already done and by arguing that writing can indeed be learned.

The next segment of the workshop emphasized the connection between talking, writing, and research. An experienced PCC staff member made a presentation on incubating ideas, on the crucial roles interaction and silence play in the creation of knowledge. He illustrated his point by leading a short activity in which the workshop participants looked at a Rorschach image and then listed, individually, three possible interpretations of the image. The students then formed small groups and shared their interpretations. Finally, working alone again, each participate wrote a paragraph that identified his/her favorite interpretation, its significance, and a justification for the choice. The parallels between this activity and the dissertation process were discussed. Building on this activity, the Coordinator of the Engineering Ethics Program (who is also a lecturer in the philosophy department) distributed a copy of the National Society of Engineers Code of Ethics and used it to talk about the ethical obligations that surround research and the communication that surrounds it. Emphasizing the relationship between writer/speaker and audience drew attention to the social nature of knowledge and made explicit the kinds of problems engineers face in negotiating their audience's needs and expectations, and their own research experiences.

Participants were asked to bring a page of their own writing for a brief writing activity. Drawing on Joseph Williams' *Style: Ten Lessons in Clarity and Grace (*6, pp. 100-113*)*, the PCC staff made a short presentation on the principles of cohesion, specifically the

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idea that sentences should move from old information to new information to aid the reader in understanding the relationship between ideas. Paragraphs taken from actual dissertations completed within the USC College of Engineering and Information Technology were used to illustrate the principle. The participants then analyzed the page they had brought with them, checking each sentence to see that it moved from old to new information.

Next, two PCC staff members spoke about their experiences with the dissertation. Because family and friends outside the academy cannot always understand the dissertation process or the stress it entails, graduate students need to hear first-hand accounts from people who have recently gone through—or are currently going through—the experience. This kind of mentoring can be invaluable in motivating students and allaying their fears. Making visible the invisible experience forms a central function of mentoring. Thus, these presentations highlighted the idea of writing as recursive and generative. Suggestions included using the proposal as a planning document, using a white board or some other visual system to map ideas and progress, employing freewriting as a means to overcome procrastination or writing fear, and meeting regularly with a faculty member or graduate student to read and discuss weekly installments. Having such conversations during all stages of the project enables the writer to explore ideas with a real audience before the final deadline when it is usually too late to make substantial changes, gives the writer concrete deadlines that are invaluable for staying on schedule and finishing on time, and provides mentoring opportunities.

The final portion of the workshop consisted of peer-led, discipline-specific breakout discussions on managing the dissertation process. The groups considered issues such as how to keep from feeling overwhelmed, what kinds of difficulties they have encountered and how they solved them, how to deal with problems with their directors, what kind of writing process they have, and so forth. These groups enabled students not only to find out new, useful information, but also to think more self-consciously about their own processes and to form support systems within their own departments. Although each group was given a list of possible topics to cover, most groups used the list as a springboard to move on to other, more individualized topics.

At the end of this workshop, participants received a packet of handouts to use throughout the dissertation process. The packet included a list of dissertation and writing websites; a handout suggesting productive things to do when you cannot sit down and write; a copy of "A Guide to the Preparation of Theses and Dissertations in Science and Engineering," by Hillary Hart and Desmond F. Lawler (University of Texas at Austin) (7); a list of commonly used transitions; a collection of time management tips; and a few jokes and cartoons about the dissertation process.

Overall, the participants found the workshop to be useful, especially in its focus on the process of writing, its intent to build confidence, and its practical writing tips. Students were interested in obtaining further information on format and technical features of the dissertation and on additional writing tips. The former were covered on several of the

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handouts distributed at the end of the workshop, and the latter were emphasized in future workshops and during individual consultations in the PCC.

Workshop on writing in the profession

From their earliest days in graduate school, engineers seeking graduate degrees are exhorted to begin writing for publication as soon as possible. Publication, as graduate directors and engineering faculty explain, is the process by which engineering knowledge is advanced. It is also a vital part of the process through which individuals advance professionally. Unfortunately, exhortation alone seldom produces a publishable article. Nor do good intentions or excellent data automatically result in publication. Producing journal articles for publication requires knowledge of the writing process, experience in writing, and support throughout drafting and editing the text. Engineering graduate students seldom have much knowledge of and experience in writing beyond the limited instruction and practice they receive as undergraduates. Clearly, most engineering graduate students can benefit from expert guidance in writing and preparing manuscripts for publication. Not only do they lack experience in writing but they also have little knowledge of the publication process. Recognizing this serious gap in graduate students' preparation is the starting point for improving their output of refereed articles and conference presentations.

The third offering in the series of workshops for engineering graduate students at USC, as outlined below, gave participants several insiders' views of academic writing and publication.

Outline - Workshop on Writing for Publication
March 2001

Welcome and introductions
Panel Discussion: 70 minutes
- "Publishing a Refereed Paper"
  - Acting Chair, Department of Chemical Engineering
- "The Journal Review Process"
  - Professor of Computer Engineering
- "Publishing Early in the Academic Career"
  - Professor of Civil Engineering
- "Editing for Coherence and Clarity"
  - Discussion and exercise led by PCC director

The workshop format was a roundtable of three engineering faculty with varying years of experience and degrees of involvement in publication. The first speaker, Acting Chair of the Department of Chemical Engineering, outlined and answered FAQs about publishing a refereed paper, starting with the definition and ending with the process of preparing a refereed paper. To engage students in discussing the phases of publications, he first asked students to complete the following worksheet:

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Worksheet: Publishing a Refereed Paper*

What is a "refereed paper" (also known as a "peer-reviewed" paper)?

1. Why is it important to publish refereed papers?
2. What is the role of the journal editor?
3. How are the anonymous peer reviewers chosen?
4. How do I select the journal in which to publish?
5. Describe the process of publishing, from submission of the original manuscript to its ultimate appearance in the journal.
6. What can be done to ease the process of preparing a paper and to increase the likelihood of its publication?

***** Worksheet created by Dr. Michael Matthews, USC Department of Chemical Engineering

Next, the engineering professor answered the worksheet questions and engaged students in conversations about each point. The discussion included practical suggestions for selecting journals in which to publish and increasing the chances of being published. It also gave the graduate students an insight into the peer review process and the final editing of journal papers.

The second talk, presented by a professor of computer engineering who has served as an Associate Editor for IEEE *Transactions on Reliability*, was an overview of the article review process. Using a flow chart, the professor described the roles of referees and associate editors in identifying ways to improve and clarify research articles. The third speaker, a professor of civil engineering, discussed writing for publication from the perspective of a younger faculty member working toward tenure. Following an open discussion between the graduate students and faculty panel on issues related to publication, the PCC Director led a brief exercise on revising and editing for cohesion and clarity.

All of the participating graduate students rated the workshop "very useful" or "useful." Half of those responding to the evaluation questionnaire said that they were currently involved in writing an article. One wrote, as a result of the workshop, "I understand what publishers look for, so this definitely will help me in completing the article I'm working on." Other comments showed that students have considerable interest in the publication process and on managing their writing processes, and that they found the workshop information valuable.

Workshop on the job search

Because the final year of graduate school is devoted almost solely to the thesis/dissertation process, the job search often gets overlooked. Students mistakenly believe preparing an employment application takes minimal time, and, therefore, they often wait until late in the year to begin. Students express frustration at their inability to procure sample documents (resumes, c.v.'s, cover letters, etc.) and information concerning what to expect from the process. Moreover, they often lack knowledge of the services available on campus to help them with their searches, and directors do not

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always have the time or resources to mentor students in the job search. The final workshop, therefore, focused on writing related to the job search.

As previous workshop participants had expressed interest in academic and non-academic jobs, the event addressed both sectors, as outlined below:

Outline –Workshop on the Job Search
April 2001

Welcome and Introductions
"The Non-Academic Job Search" (40 minutes)
Speaker: Program manager for engineering and information technology, USC Career Services
"The Academic Job Search" (40 minutes)
Speaker: Assistant Professor, Dept. of Chemical Engineering

USC Career Services employs a program manager for engineering and information technology, and the program's services are widely used by engineering undergraduates. As the services are less well known to graduate students, the program director presented an overview of the non-academic job search for engineers with advanced degrees. A new hire in chemical engineering also agreed to share his insight into a successful search. During the workshop, each presenter gave an overview of a typical job search and provided handouts and sample documents. These handouts included information on resumes vs. vitae; services offered at Career Services; cover letters; interviewing tips and sample interview questions; hints for successful salary negotiation; and sample resumes, vitae, cover letters, and research proposals. In addition, students received a list of academic job search websites and a copy of "Finding an Academic Job: The Process and the Pitfalls" by Jonathan A. Dantzig, Department of Mechanical Engineering, University of Illinois at Urbana-Champaign (8).

Overwhelmingly, students found this workshop to be very useful. They appreciated learning basic procedures and strategies, and, perhaps most importantly, where to go for help during the process. Their evaluations suggested interest in future workshops dealing specifically with interviewing, a topic that was not covered thoroughly due to time limitations.

Conclusions and recommendations

Both graduate student and faculty response to the workshops support the need to provide continuing emphasis on communications in graduate education. In expressing appreciation for the faculty presentations and discussions, the graduate students reflect a national trend in graduate education: students, according to Gonzalez, are "requesting more and better mentoring." She notes, "The doctoral level—the traditional core of graduate education—is now populated by students with a deep interest in teaching and mentoring"(9). The workshops, with their informality and the open dialogue between faculty and graduate students, complement the individual mentoring relationships

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between graduate students and their advisors or research directors. The workshops, by making communications part of the dialogue among professionals at several levels, also called attention to the integral role of communications in the research process and in the working lives of academic and research engineers.

The workshops were also well supported by engineering faculty. Every professor who was asked to participate did so without hesitation. Research directors and other faculty members encouraged graduate students to attend. Although participating faculty were not asked to evaluate the effectiveness of the workshops, their positive comments about the topics and structure of the sessions indicated an endorsement of the approach. Some of the faculty speakers were pleased to share information they had developed for their own classes with a larger group. The short presentations were effective, the format allowed for faculty participation from all departments and a number of research projects, and the commitment required a minimum of faculty time.

The staff of the Professional Communications Center found the workshops especially helpful in improving consultation to graduate students writing theses, dissertations, articles, and career communications. The discussions among all the participants—faculty and students alike—provided insight into communications situations and audiences in engineering that no case study or textbook can convey. Being a part of this dialogue among professionals is essential for communications faculty in designing effective ways to support the communications efforts of engineering researchers. The graduate students' responses to the evaluation questionnaires also made a substantial contribution to the communications consultants' work in planning and organizing the workshops. Their candid comments and requests for specific information made planning and teaching the sessions a pleasure.

Because the workshops were collaborative efforts and drew on existing resources, the activity was extremely economical. Organizing the workshops, inviting professors to speak, publicizing the meetings via email, and collecting and copying handout materials were the major administrative tasks. These were handled by the Professional Communications Center staff with few problems. In engineering colleges that do not have a similar program, administrative details could be handled by a department's staff. However, establishing collaboration among engineering and communications faculty becomes more challenging in engineering colleges without writing or communications programs. As an alternative, faculty from the university's programs in technical and professional writing or writing in the disciplines could be invited to participate with engineering faculty in organizing and presenting the workshops. In any case, the key to planning and conducting communications workshops for graduate students is collaboration and communication among all the participants—faculty from various disciplines and the students themselves. Through continuing collaboration and dialogue, learners—novices and experts alike—learn from each other and learn how to become life-long students and practitioners of excellent communications.

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3. Alford, E. (1997) Training TAs to Help Students Learn Engineering Discourse. *Proceedings*. 1997 Frontiers in Education Conference. Pittsburgh, PA. 5-8 November 1997.

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9. Gonzalez, C. (2001) Undergraduate Research, Graduate Mentoring, and the University's Mission. *Science Magazine* 293 (5535), pp. 1624-1626.

Additional References - Useful Websites

Thesis/Dissertation Workshop

UNC Writing Center Handout "Writing Your Dissertation"
<http://naples.cc.stonybrook.edu/Pres/boyer.nsf/>
Graduate Student Resources on the Web
<http://www-personal.umich.edu/~danhorn/graduate.html>
The ABD Newsletter
http://www.mentorcoach.com/abd

Writing in the Profession

Bibliography for Writing for Scholarly Publication (1997)
http://www.raycom/twarren/bibwrpub.html
Very extensive bibliography covering engineering and other disciplines
ALPSP/EASE Peer Review Survey (Oct.-Nov. 2000)
http://www.learned-publishing.org/peerev.pdf
A survey taken to "achieve a greater understanding of the peer review process in a variety of disciplines and to provide a set of agreed guidelines.
The Association of Learned and Professional Society Publishers
http://www.alpsp.org/
Includes information on copyright regulations, journals/publishers, etc.; advice on publishing
Copyright and Fair Use, Intellectual Property, and Patents
http://fairuse.stanford.edu/articles/
Developing and Writing Grant Proposals
http://www.cfda.gov/public/cat-writing.htm

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Writing a Grant Proposal
http://cpmcnet.columbia.edu/research/writing.htm
A Guide for Proposal Writing (NSF)
http://www.nsf.gov/cgi-bin/getpub?nsf9891

Academic Job Search Websites

"Landing an Academic Job: The Process and the Pitfalls"
excellent article; includes thorough explanation of the process and sample letters
<http://quattro.me.uiuc.edu/~jon/ACAJOB/Latex2e/academic_job/academic_job.html>
<http://ccrma-www.stanford.edu/~unjung/guide/academic_job.html>
Science Magazine's Next Wave
NextWave, the weekly on-line publication devoted to scientific training and career development, provides global news, profiles of emerging careers, and advice from experts and role models drawn from your international scientific community.
<http://nextwave.sciencemag.org/
Academic Career and Job Search
includes information on each step of the process
<http://career.berkeley.edu/PhDs/PhDs.stm>
PhDs.org Science, Math, and Engineering Career Resources
<http://www.phds.org/>
<http://www.phds.org/links/index.cfm?setTopic=1&CFID=43536&CFTOKEN=71321034>
Academic Job Application Checklist
<http://www.otal.umd.edu/~sies/jobchecklist.html>
CVs, Cover Letters, and Teaching Portfolio
<http://www.cpp.umich.edu/cpp/students/grad/academicjob/appli.htm>
Academic Job Interview and Job Talk Advice
<http://www.cpp.umich.edu/cpp/students/grad/academicjob/acadintv.htm>
Sample Interview Questions
<http://www.otal.umd.edu/~sies/jobquess.html> (very good list)
<http://www.columbia.edu/cu/ccs/99website/99student/exploration/interview/>

Academic Job Listings (these are just a few of the many sites that list academics jobs):
Chronicle of Higher Education (also contains articles about the job search, sample letters, etc.)
<http://chronicle.com/jobs/>
Chronicle of Higher Education Engineering Jobs (Academic) (updated weekly)
<http://jobs.chronicle.com/free/jobs/faculty/scitech/engin/links.htm>
Job Resources in Higher Education (includes information on job openings, cover letters, cv's, etc.)
<http://www.higher-ed.org/>
University Job Bank
<http://www.ujobbank.com/>
Post-Docs.com
<http://www.post-docs.com/>

See Also Martin Yate's *Knock 'em Dead 2001: The Ultimate Job-Seeker's Resource with Great Answers to 200 Tough Interview Questions* ($12.95)

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