

# A Professional Development Program for Graduate Students at North Carolina State University\*

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## I. Introduction

The traditional engineering graduate school experience involves taking courses, selecting a dissertation or thesis advisor and project, performing the research under the advisor's supervision, and completing and defending the dissertation. Such an experience trains graduate students to carry out research on a problem someone else has defined and gotten funded. It does not, however, prepare them for anything else they might be called upon to do in graduate school and in their professional careers, including:

- **Teaching assistant responsibilities.** Grade assignments, projects, and tests; supervise laboratories; work with students in office hours; teach recitations and cover classes for faculty members.
- **Getting a job after graduation.** Choose between an academic and non-academic career; prepare a resume (or dossier or professional portfolio); prepare for a job interview. The need for such preparation is particularly acute for students who wish to pursue an academic career.
- **Getting a faculty career off to a good start.** Define research projects, write successful proposals to fund them, attract graduate students to work on them, plan new courses, teach them effectively, manage the time demands imposed by research, teaching, and personal life, and integrate into the local campus culture. Some universities provide guidance on these tasks to new faculty members, but most do not.

All academic programs of the 16-campus University of North Carolina system that use graduate teaching assistants are required to provide the TAs with preliminary training. For many years, the North Carolina State University (NCSU) College of Engineering met this requirement by sending its new TAs to a day-long campus-wide workshop. Many of the graduate students complained that the workshop was too general to be of much value—their perception was that the things they needed to know to be TAs in engineering were different from what TAs in humanities and social science and business and management courses needed.

Ronkowski<sup>1</sup> presents a number of strong arguments supporting that perception. She notes that the structure of knowledge and appropriate strategies for conveying that knowledge vary considerably from one discipline to another, and suggests that development programs for graduate students (and faculty) are best presented in a disciplinary context. A number of engineering schools have published descriptions of their graduate student training programs. The program topics fall into two somewhat overlapping categories: (1) common TA responsibilities, such as grading and assisting in laboratories<sup>2</sup> and (2) teaching.<sup>2-10</sup>

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The most effective discipline-specific TA training program we know of is one that has been conducted for many years in the College of Engineering at Cornell University.<sup>2</sup> Training is provided in a series of required and elective workshops held early in the fall semester and conducted by “TA Fellows,” graduate students who are alumni of the training program. We considered many of the features of this program exemplary and proposed initiating an engineering TA training program at N.C. State similar to Cornell’s, except that it would use primarily faculty workshop presenters rather than graduate students. The Dean of Engineering approved this proposal, and in 2001 we initiated a series of workshops for all new engineering teaching assistants on different aspects of their responsibilities. Soon afterwards, we proposed to create a separate workshop to prepare doctoral candidates to successfully seek and embark on academic careers. We did not find any published models for such a session and so created one ourselves, and again the Dean agreed to sponsor it.

The NCSU Engineering Graduate Student Professional Development Program now consists of the following components:

- 1. Graduate teaching assistant training.** A series of workshops for new engineering teaching assistants on topics that include grading, dealing with student problems, preparing and delivering effective class and lab sessions, and using instructional and course management technology.
- 2. Orientation to faculty careers.** A one-day workshop for engineering graduate students that provides guidance on obtaining an academic position, starting a research program, teaching a course for the first time, and integrating into the faculty culture.

In addition, the college requires all of its graduate students to participate in a university-sponsored session on harassment awareness and prevention and encourages them to take part in several university-sponsored programs, including a Preparing the Professoriate mentorship program, a course on college teaching, and a teaching certificate program.

This paper describes the College of Engineering program elements, summarizes participant evaluations, and offers suggestions to institutions thinking of establishing similar programs.

## **II. Graduate Teaching Assistant Training**

### **A. Program Structure**

The NCSU professional development program for engineering graduate students has gone through several evolutionary changes since its inception. In its present form, all new TAs are now required to attend an introductory 3-hour workshop called “Survival Skills for Engineering Teaching Assistants” and at least one of several 1.5-hour elective workshops on (a) grading homework and tests, (b) using instructional technology, (c) learning and teaching styles (intended primarily for TAs who will be covering lecture classes and recitation sections), and (d) “Tips from the Trenches,” a workshop inspired by the Cornell model led by an experienced TA and a faculty member. Students are required to attend the workshop that most closely matches their TA responsibilities and their personal interests, and they are invited to attend any of the others. The workshops are outlined in Table 1.

**Table 1. TA Training Workshops**

<b>Required Sessions</b>	
1. Survival skills for graduate teaching assistants <ul style="list-style-type: none"> <li>– <i>Crisis clinic</i>. With little or no guidance, TAs are called on to (a) grade homework in an unfamiliar subject, (b) grade a pop quiz with no solution key, (c) cover a lecture at short notice with no lecture notes provided. What can they do?</li> <li>– Teaching assistant roles and responsibilities</li> <li>– Tips on dealing with students’ academic problems, complaints, and crises</li> <li>– Detecting and minimizing cheating</li> <li>– Effective lecturing (written resources only)</li> <li>– Time management (written resources only)</li> </ul>	3.5 hr
<b>Elective Sessions (Students must attend at least one)</b>	
2a. I’m a grader. Now what?	1.5 hr
2b. Using technology as a teaching assistant	1.5 hr
2c. Tips from the trenches	1.5 hr
2d. Learning styles and teaching styles	1.5 hr
2e. Facilitating laboratories (no longer offered)	1.5 hr

The sections that follow outline a number of challenges we faced in designing the program and our responses to them.

**B. Finding a time to schedule the required introductory workshop.**

The Survival Skills workshop was originally given before the first day of class. The problem was that many students did not even know they were going to be TAs before the start of classes, and some of the students who knew did not know what they would be doing in their assistantships. Once classes started, there was no time during the week when all TAs would be available.

In response, the third time we gave the session we changed the time to the Saturday morning after the start of classes. This decision was not greeted with enthusiasm by most of the graduate students, and a number of strongly-expressed complaints about having to give up their Saturday morning showed up in the post-workshop evaluations. We subsequently decided to address their concerns directly by explaining at the outset why we had to schedule the workshop on Saturday, noting that we were as unhappy about it as they were. Doing that did not completely eliminate the complaints, but we now get them from no more than two or three participants instead of more than half.

**C. Motivating the TAs to attend and participate.**

Many of the new TAs did not understand why they needed training. Whether they would be grading homework and tests or running laboratories or teaching recitations, they did not see a need to know anything but the content of the courses they would be assisting with, and this

workshop clearly has nothing to do with course content. In the first workshop offerings, they conveyed their displeasure through inattention and in a few cases by leaving before the end.

We recognized that we needed to give the students a sense that there were good reasons for them to be there. To do so, we now start the workshop with an opening exercise in which we describe an incoming first-year engineering student with excellent credentials who fails several courses and drops out of engineering in his/her first year, and we ask the participants to ponder in a small-group brainstorm the question, “Why?” The TAs, most of whom are young enough to remember vividly their own college experience, collectively generate a long list of reasons why first-year students have trouble, including poor teaching, lack of help when they need it, and a sense of isolation and loneliness.

We then present a short overview called “Why are you here?” In a five-minute interval, we **(a)** show the University of North Carolina mandate for TA training (“so we have no choice about making you come to this workshop”); **(b)** observe that the country now faces a serious shortage of engineering graduates due to decreasing enrollments and high curricular attrition; **(c)** point out that many students—including some with excellent academic records—leave engineering in the first two years, in large part for the reasons that the participants came up with in the brainstorm; **(d)** observe that appropriate support and encouragement from competent teaching assistants can turn things around for many of those undergraduates, and **(e)** state that our goal in the TA training workshops is to enable the participants to do exactly that. This explanation apparently satisfies most of them, since the number of complaints we now get about their required attendance has dropped almost to zero.

#### **D. Presenting content relevant to the TAs needs (and perceived as such by them)**

Throughout the introductory training session attended by all new TAs, we use “Crisis Clinics” to cover challenges the TAs are likely to face and unlikely to know how to handle. After we describe a challenge, the participants work in small groups to discuss what they would do, and then we debrief the discussions, offering additional suggestions.

The opening Crisis Clinic is shown in Table 2. We divide the participants into three large groups, assign each of three given crises to a different group, and divide the groups into subgroups of three or four students each. The small groups are then given about two minutes to generate ideas about what the TA in the specified situation might do. After we stop them, we collect ideas for the first crisis from the subgroups who worked on it, then see if any of the other participants has additional ideas, and if we have additional suggestions (which we usually don’t) we offer them. We proceed the same way for the other two crises. The participants invariably come up with suggestions to try and find the professor before he leaves and get problem solution keys; consult with experienced TAs who have worked for the same professor and/or with other faculty members who have taught the same course to get problem solutions and possibly a lesson plan; use quiz papers submitted by two or three excellent students as the basis of constructing a solution key; and look through the course text and other texts on the same subject for guidance in solving problems and designing a lesson plan.

**Table 2. Opening Crisis Clinic**

**Was *this* in the contract?**

You are a teaching assistant in a large sophomore engineering class. Your jobs will be grading homework and tests and holding office hours for students with questions. On the first Friday of the semester the professor leaves you a note saying that he will be away all the following week at a conference.

- On the following Monday students start coming to you with homework problems that look like nothing you've ever seen before. You're not sure how to solve them and you can't make any sense out of several of the problem statements
- On Wednesday the class is given a pop quiz and the papers are left in your mailbox for grading. You are not given a solution key or told anything about how they should be graded.
- The professor's note included a request for you to cover his class on Friday. He tells you only the topics he wants you to address but does not give you a detailed lesson plan.

What do you do?

Other crisis clinics deal with students complaining about grading and about the course instructor; a student who shows clear signs of serious depression; an incident of apparent cheating; and disruptive student behavior in a recitation. In these clinics, the participants quickly come to realize that there is more to being a teaching assistant than they thought, and most get into the spirit of generating solutions and are more than ready to hear the suggestions and tips we offer them.

**E. Addressing the needs of TAs with different responsibilities.**

Some of the new teaching assistants will be graders and tutors; others will assist in experimental or computer laboratories where students primarily work on their own; still others will lead recitations; and a few will have full course teaching responsibilities. The challenge is to meet the needs of all these different groups in a limited number of hours.

Our response has been to make the opening TA training session cover only the topics that address the needs of all TAs and to use the follow-up seminars to address specialized needs. In the first session we focus on building a good relationship with the supervising instructor, helping students in office hours, proctoring and grading tests, covering lectures, and identifying relevant resources (print, electronic, and human). The workshop handout (which contains all of the material we discuss in the workshop and more) includes suggestions about lecturing and active learning that we do not cover in our presentation, since we know that most TAs will not be lecturing. For those who will be, however, the suggestions should be helpful. The handout also offers time management tips that are largely self-explanatory.

The graduate students are required to attend the follow-up seminar most relevant to their TA responsibilities and are encouraged to attend more if they are interested in them. (Most don't do so: in the fall of 2007, only six TAs out of 113 came to more than one follow-up session.) The sessions that have been offered are as follows:

- (a) **I'm a Grader. Now What?** The most common job for TAs in engineering is grading. Our session on grading, led by an award-winning teacher in Civil Engineering, consistently draws the largest attendance, usually a little over 50% of all TAs who came to the introductory session. This session gives the participants hands-on practice in grading representative student work.
- (b) **Using Technology as a TA.** This session is delivered by the College of Engineering's Director of Assessment as a synchronous online seminar using the software Elluminate. In it, TAs learn about many available technological tools to help them communicate with students and organize their work.
- (c) **Tips from the Trenches.** An experienced TA and a faculty member lead this highly interactive session, offering advice and practical tips from the TAs point of view. (A separate presentation about this session is part of this ASEE conference.)
- (d) **How Students Learn, How Teachers Teach, and What Goes Wrong.** Occasionally a session on learning and teaching styles is offered for graduate students with teaching as part of their responsibilities or who are contemplating academic careers.
- (e) **Facilitating Labs.** In the first years of the training, a session was offered on assisting in laboratories. It was dropped in 2006 because of low demand.

**F. Keeping the participants awake.** Like any students, TAs get bored and tune out in class if they are not actively engaged. Participatory activities are used extensively to involve students throughout each workshop, and lecturing is interspersed with a variety of other presentation formats with injections of humor as much as possible. For instance, to introduce the topic of office hour tutoring in the introductory workshop, we role-play a student seeking help from the worst TA in the history of the world. The participants are asked to list all the things that made the session ineffective and have a lot of fun identifying the shortcomings of the fictional TA. Then we role-play the same situation using recommended techniques and have the participants identify what made the second session more effective. The TAs often comment on this activity as having been particularly enjoyable.

### **G. Participant Ratings.**

At the end of each session, we have the participants complete feedback forms in which they rate key elements of the session and the overall workshop and offer comments on what they liked and what they think could be improved. We have used the feedback to improve the sessions over time. Table 3 summarizes the ratings of all workshops given since 2001, based on a Likert scale of 1(poor), 2, 3(average), 4, 5(excellent).

**Table 3. Training Session Ratings 2001-2007**

Session	2001(N)	2002(N)	2003(N)	2004(N)	2005(N)	2006(N)	2007(N)
Survival skills	4.3(111)	4.1(86)	4.4(123)	4.5(142)	4.3(111)	4.7(91)	4.7(103)
Grading	4.4(61)	4.2(53)	4.0(68)	4.4(57)	4.4(61)	4.4(55)	4.5(62)
Laboratories	4.3(26)	3.9(23)		4.1(17)	4.3(26)		
Learning styles	4.6(33)	4.2(38)	4.5(38)	4.5(29)	4.6(33)		
Technology						4.0(23)	4.1(19)
Tips from Trenches						4.6(22)	4.2(23)

In 2005, two assessments were carried out. The first one was done at the end of each workshop, and the second at the end of the semester when the students could assess how useful the workshops were in preparing them for their TA duties. Both sets of data—put on a common basis of 5 points for the top rating, 3 points for an average rating, and 1 point for the lowest rating—are shown in Table 4. All of the workshops received average post-workshop ratings between 4 and 5. The post-semester ratings are consistent with those collected immediately after the workshops, and indicate that most students not only appreciated the workshops when they took them but found them to have been good preparation for what they ended up doing as teaching assistants.

**Table 4. Immediate and Post-Semester Ratings of 2005 TA Training Workshops**

Workshop	Post-workshop rating <sup>†</sup> (N)	Post-semester Rating <sup>‡</sup> (N)
Survival skills	4.3 (111)	4.1 (86)
Grading	4.4 ( 61)	4.2 (53)
Laboratories	4.3 ( 26)	3.9 (23)
Learning/teaching styles	4.6 ( 33)	4.2 (38)

<sup>†</sup> Average rating of the workshop on a scale from 1(poor) to 5(excellent)

<sup>‡</sup> Average agreement with the statement “The session helped me perform my role as a TA,” with 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree

We are gratified by how positive these ratings are—particularly the post-semester ratings, which reflect the students’ evaluations of the value of the workshops in light of their actual experience as TAs. At the same time, evaluation of the effectiveness of training programs based exclusively on self-assessment definitely has its limits, and one might wish for student ratings of the TAs’ performance with which to triangulate the self-assessments. Unfortunately, the engineering departments at this university do not collect such data except in the very rare cases when teaching assistants actually take responsibility for teaching a section of a course. Moreover, student ratings of a teaching assistant are likely to be influenced by many factors, including the TA’s personality, so that the only way inferences could be drawn about the workshop effectiveness from those ratings would be to compare them with ratings of a control group of TAs who did not take the workshops. Since there is no such control group (all engineering TAs are required to participate in the program, and they take it before they have any TA experience so there is no possibility of comparing pre-workshop and post-workshop ratings), the assessment results reported in Table 4 have to suffice.

### III. Introduction to Faculty Careers for Graduate Students

The College of Engineering administration believes that besides training teaching assistants, it should provide some guidance to graduate students contemplating academic careers, both to improve their chances of getting a faculty position and to shorten the learning curve for them once they get one. To this end, in 2005 the College began offering a 5-hour session called “Introduction to Faculty Careers” which includes material on applying for faculty positions, getting a research program started, and effective teaching. The workshop content is outlined in Table 5.

The faculty careers workshop is highly participatory, with activities that include critiquing research descriptions, writing learning objectives, and discussing possible solutions to problems commonly encountered by new faculty members. Of the 84 participants who submitted evaluations in the two workshop offerings, 63 gave the workshop the top rating of “5(excellent),” 20 gave it “4,” one gave it “3(average),” and none gave it “2” or “1,” leading to a overall evaluation of 4.74.

**Table 5. Faculty Careers Workshop**

<ul style="list-style-type: none"> <li>• <b>Introduction and overview of workshop</b></li> <li>• <b>Preparing for an academic job search</b> <ul style="list-style-type: none"> <li>– Steps graduate students can take to improve their prospects for getting and succeeding in a faculty position</li> <li>– Writing an effective cover letter, CV, and statements of research and teaching plans</li> <li>– Being ready for likely interview questions</li> </ul> </li> </ul>	1.0 hr
<ul style="list-style-type: none"> <li>• <b>Starting a research program</b> <ul style="list-style-type: none"> <li>– Identifying funding sources and writing successful proposals</li> <li>– The NSF CAREER program</li> <li>– Attracting graduate students to your research program</li> </ul> </li> </ul>	1.5 hr
<ul style="list-style-type: none"> <li>• <b>Planning and teaching the first course</b> <ul style="list-style-type: none"> <li>– ABET and learning objectives</li> <li>– Preparing a syllabus</li> <li>– Active learning</li> </ul> </li> </ul>	1.5 hr
<ul style="list-style-type: none"> <li>• <b>Success strategies for new faculty members</b> (based on the work of Robert Boice[2000])</li> </ul>	0.5 hr
<ul style="list-style-type: none"> <li>• <b>Open discussion</b></li> </ul>	0.5 hr

### IV. University Programs

In addition to the workshops offered by the college and the required university seminar on harassment awareness and prevention, graduate students are encouraged to take advantage of several university-wide programs.

- *The “Preparing the Professoriate” program.* Graduate students pair with faculty mentors for a year, usually co-teaching with them and occasionally engaging in joint educational research projects. The mentees also attend a series of seminars on education-related topics.

- *Course on college teaching.* A semester-long course is offered to give graduate students a thorough grounding in the essentials of teaching.
- *Certificate of Accomplishment in Teaching.* The NCSU Faculty Center for Teaching and Learning sponsors a program in which graduate students prepare a teaching portfolio and complete a series of seminars and workshop to earn a certificate in teaching.

## V. Recommendations

The professional development program for engineering graduate students at N.C. State University described in this paper has two primary functions: (1) to prepare new graduate teaching assistants to carry out their functions effectively, and (2) to help prepare graduate students contemplating academic careers to find positions and get their careers off to a good start. Based on our experience, we offer the following suggestions to engineering schools contemplating similar programs.

- *Keep most of the program within engineering.* Designate someone in engineering to coordinate the program and have engineering faculty members take primary responsibility for designing and facilitating the program components. Use engineering examples whenever possible to illustrate methods recommended in workshops and seminars.
- *Get administrative buy-in.* If the Dean is enthusiastic about the program, commits enough funds to support the program staff and workshop presenters, and enlists the support of the department heads, the program is likely to last beyond its first year. If the department heads and graduate administrators require or strongly encourage their graduate students to participate, the students will have an excellent chance of becoming effective teaching assistants and a good start toward finding and succeeding in faculty positions if they choose that career path.
- *Select good teachers as TA workshop facilitators and keep the presentations practical and relevant to the needs of the participants.* Don't give long presentations about pedagogical theories and methods to graduate students who will only be grading papers, facilitating labs, and conducting office hours; rather, keep the focus on things they can do next Monday, citing references for those who wish to know more. Have separate sessions to deal with topics of interest to some but not all of the new TAs.
- *Keep things active.* Straight lectures and hour-long PowerPoint shows are no more effective in workshops than they are in classes. Include frequent activities that center on challenges TAs commonly face and demonstrations of good and bad ways to deal with them.
- *Coordinate activities with campus-wide programs for new faculty and graduate students, such as Preparing the Professoriate mentoring programs and courses and workshops on effective teaching.* Campus teaching center personnel may also participate as co-presenters or co-facilitators in professional development programs.
- *Cultivate continued administrative support by reporting to the dean and department heads annually.* Get on the agenda of an Executive and/or Graduate Studies Committee meeting every year and report on the status professional development program elements. Doing so introduces new department heads and graduate administrators to the program, helps keep the program fresh in the minds of all administrators, and gives them an opportunity to ask questions and offer suggestions for program additions or modifications.

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