AC 2009-799: PREPARING GRADUATE ENGINEERING STUDENTS FOR ACADEMIA: ASSESSMENT OF A TEACHING FELLOWSHIP

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Preparing Graduate Engineering Students for Academia: Assessment of a Teaching Fellowship

Abstract:

We report on a graduate teaching fellowship program with the objective of mentoring doctoral students through teaching experience. Incoming doctoral students compete for these prestigious assistantships, which award students with a tablet PC, augmented stipend, and increasing teaching responsibility over three years. The first year of the program is spent teaching a freshman engineering course. The second year graduate fellows serve as instructors for an upper level course in their home departments. As a follow on to a previous assessment of the first year, this paper focuses on an assessment of the second year of the program, in which graduate fellows are closer to their departments' technical expertise but isolated from each other. Qualitative interview data was collected from both the graduate fellows and their faculty mentors and analyzed to evaluate the fellows' teaching and mentoring experiences as instructors within their respective departments. It was found that the fellows experienced a large increase in workload compared to the freshman teaching assignment, but they enjoyed the increased level of responsibility. Fellows also felt that this increased workload enhanced their time management skills and ability to balance a teaching and research agenda, skills that they would need to be successful as future professors. Various practices were used by faculty mentors including: weekly meetings, class observations, class observation feedback journals, and formal and informal course planning sessions. Mentors observed positive gains in the fellows' speaking, presentation, and time management skills. Additionally mentors noted that while the goal of the fellowship was met, the written guidelines should be clearer to facilitate the fellows' transition between the levels of responsibility within the program. Fellows commented they experienced very little interaction with the other fellows or mentors from outside their department, compared to the first year program. Recommendations include adding social or continued development activities, reviewing the fellowship guidelines, and establishing an interdepartmental feedback and review system.

I. Introduction

While those holding faculty positions within a college or university are expected to be active in research, teaching, service and outreach, little is done at the graduate level to prepare students for the demands of balancing these roles. Many students who complete a doctoral degree have strong backgrounds in research and generating scholarly publications, but have limited practical experience balancing the responsibilities of a junior faculty member. This paper describes the assessment of a Graduate Teaching Fellowship (GTF) program that was developed to address this deficiency. The primary objective of the GTF program is to better prepare interested doctoral students for an academic career in a university setting, with central programmatic focus on the instructional aspects of being a faculty member. The exact timeline for each fellow varies slightly, but the prescribed program progression has the fellow teaching the first year with the college's freshman program, then moving to his or her home department for two years of a mentored teaching experience. The fellow will see an increase in teaching responsibility that spans the 3 years of the program, culminating in sole responsibility for an

undergraduate course. A detailed program description [1] includes the major results from the initial assessment conducted in 2006, which are summarized here.

The major findings from the 2006 assessment were that students felt there was an increase in workload due to the time spent learning material that was not a part of their degree-granting department and teaching a course for the first time. They also mentioned the difficulty in getting research done while teaching. Evaluations completed by faculty (formative assessment) and freshman students (summative) were used to evaluate mentoring and feedback processes. Workshop leaders considered the faculty evaluations very useful feedback, but felt that the university wide student evaluations were less relevant. In response to this criticism, a new form was developed that is more appropriate to their responsibilities as workshop leaders. Community development resulted from student interactions in prescribed meetings and beyond, when students visited others' workshops and met in more informal social settings.

The aim of the current study is to examine the experience of the fellows in the second year of the program, when they are assigned to teach in their degree-granting departments. To conduct this assessment we addressed the following research questions:

1. Are Graduate Teaching Fellows receiving appropriate training and mentoring for their teaching activities in their respective departments to assist them in balancing the demands of a junior faculty member?

2. How is the teaching community of practice (CoP) developed, extended or expanded during the second year of the GTF program?

3. In what ways could this program, and similar programs, be modified to better address graduate student preparation for faculty careers?

II. Literature Review

Many universities recognize the importance of preparing graduate students for teaching assignments [2-7]. Existing programs take many forms, from the Preparing the Future Faculty (PFF) initiative to programs that train Graduate Teaching Assistants (GTA's) [8]. The depth of these programs varies widely as well, from a one-time hour long workshop to a series of courses to mentored teaching experiences. Each of these programs is designed to meet the unique needs of the university at which it was implemented. A training program developed in the Department of Mechanical Engineering and Engineering Mechanics at Michigan Technological University was designed to achieve dual objectives: to improve the quality of undergraduate instruction by GTA's and to develop leadership skills in graduate students for their professional growth [9]. Arizona State University designed a two year program, consisting of an exploratory phase and a participatory phase. In the exploratory phase students visit partner campuses to get a general idea of the institutions' respective environments, selecting a mentor from the partnering institutions during their second year [10]. Programs like these highlight many of the important elements in preparing graduate students for the demands of an academic career. The GTF program currently being assessed was designed to combine elements from other successful

programs into a holistic approach to graduate student training that focuses on the integration of teaching, research and service.

The research questions will be investigated using the concept of a community of practice [11, 12] to address the mentoring and teaching communities, as well as the social and academic interaction of the fellows with their mentors and peers. The final question concerning the preparation of fellows for faculty careers will be addressed using the model of a "steward of the discipline" presented in *Envisioning the Future of Doctoral Education* [13].

Communities of practice (CoP) are groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis [11]. Over time, they develop a unique perspective on their topic as well as a body of common knowledge, practices, and approaches. They may even develop a common sense of identity [11]. Wenger et al. propose a three-fold structural model for communities of practice: domain, community and practice. A well-defined domain legitimizes the community by affirming its purpose and value to members and other stakeholders. This is analogous to perception of the identity of the fellowship program. The community creates the social fabric of learning. A strong community fosters interactions and relationships based on mutual respect and trust. This relates to the relationship between the mentor and the fellow or the fellow and their network of peers. Both the mentor/fellow and fellow/peer relationships strengthen (or weaken) the student's feeling of belonging within the current academic community and future professional community (domain). Finally the practice is a set of frameworks, ideas, tools, information, styles, language, stories, and documents that community members share. The concept of practice can be thought of in terms of the pedagogy and culture that encompass educating future engineers. These three dimensions, (domain, community and practice) form the basis of the structural model of the community of practice as originally presented by Wenger [14].

Several other researchers have used the CoP model as a framework for addressing other communities in a university setting. [12] discuss how organizational partnerships were formed in the context of engineering education research workshops, and the formation of a CoP among workshop participants. They conclude with some recommendations for those who may want to use the CoP model to further their own communities. These recommendations include the importance of refreshing the "core" members of the community from those in the affiliated ranks. They also emphasize the importance of welcoming newcomers to keep the energy flowing within the community (p 5). Other researchers have emphasized the importance of community in fostering a successful program[15, 16]. Golde and Walker (2006) present the concept of a "steward of the discipline" as a scholar who will "creatively generate new knowledge … and responsibly transform those understandings through writing, teaching, and application (pg 5)". They go on to make the point that stewardship is not an innate quality, but one that can be developed, and therefore the fundamental mission of doctoral education should be to develop these *stewards of the discipline*. There are differing opinions on what type of training should be given to doctoral candidates during their course of study. Stacy (2006), in her essay published in [17], states that graduate PhD's are not prepared to teach, nor are they prepared to mentor graduate researchers. Yet every year universities across the country graduate PhD students, who become brand new assistant professors, and expect them to succeed at conducting research, teaching, and

mentoring graduate students; a combination of roles that they were never prepared for. It is this vacancy that programs, such as the GTF program, attempt to fill, because being a steward entails much more than just conducting research. It's about transforming that knowledge to those that will be able to carry the discipline into the future. Golde and Walker make the assertion that formulation of what stewardship means is discipline specific, meaning what stewardship looks like in chemistry, is different from English or engineering. The focus of the following paper is to examine the assessment of the GTF program and the extent to which we are preparing fellows to take on the role of *stewards of engineering.*

III. Assessment Methods

A. Setting and Participants

The setting for this study was various engineering departments at a large state university. The GTF program, which just concluded its second year, has fellows and faculty mentors that represent several engineering departments. At the beginning of the fellows third year, five fellows (three female and two male) and four faculty mentors were interviewed by a graduate assistant with teaching experience in another department. Five different engineering disciplines were represented: biological systems, civil, industrial and systems, mining and minerals, and mechanical. All five fellows applied for the GTF program to gain teaching experience because they were considering a career in academia. While the timeline for pursuing a faculty position varied, all five students remained intent, and in one case even more intent, on obtaining a faculty position. Of the five students interviewed for this program, three remain with the program for a third year; one has completed their PhD and is currently a faculty member, and the other has elected to accept a research fellowship. Additionally, four faculty research and/or teaching mentors (one female and three male) from four different engineering departments were interviewed. In all four cases the faculty member served as the fellows' research advisor, with three of the four taking on the role of teaching mentor as well. In the one case where the research advisor chose not to act as the teaching mentor, the fellow solicited teaching advice from another faculty member (unable to be interviewed for this assessment). Many fellows cited the participation of additional faculty members in mentoring the fellows teaching experience, but these faculty members were either unavailable or declined the request to interview.

B. Data Collection

The principal data sources for this formative assessment were interviews of the fellows and their faculty mentors and research advisors. Permission to solicit the participants for interviews was obtained through human subjects (IRB) review. During the first few weeks of the fall semester, all fellows who had completed a second year with the program were invited to interview regarding their experiences from the previous year (second year as a GTF). Each of the five fellows agreed to interview, and written consent was obtained to audio record the interview for clarification and accuracy of direct quotations. Upon completion of the fellows' interview, mentors and research advisors were identified for subsequent interviews. A total of nine interviews were conducted over a two week time period, with each interview averaging about 30 minutes. A semi structured set of interview questions was used for both the faculty members and the fellows; a complete list of interview questions is given in the appendix. Each

interviewee was asked all of the items, with probing questions added to garner additional details and clarification. Of the 13 total questions (faculty and fellow), the five interview questions analyzed for this paper are:

Graduate Teaching Fellows:

1. Did you receive adequate mentoring for your second year teaching assignment? Is there any advice or examples of practices we can tell other mentors about?

2. What were the major differences between the first and second semester during the second year of your GTF program?

3. How do you balance your teaching and research interests?

Faculty Mentors:

1. What impact has the GTF program had on __[fellows]__'s success?

2. What benefits do you see in this program? How might the GTF program be improved?

C. Data Analysis

Constant Comparative method [18] was used to systematically analyze the data and arrive at conclusions. Based on the results from the first year assessment, and highlighted in other sources [11, 13, 14] we developed an initial visual representation of the coding scheme. This visual representation was created to begin grouping the interview comments into general categories, and to determine the relationship between them. This initial coding scheme made determining categories possible, while still allowing for additional themes to emerge. It was also instrumental in developing the relationship between emerging themes, and how these related back to the research questions and theoretical framework. Four categories originally emerged from the data: mentoring experience between faculty mentors and fellows; peer mentoring and networking; the fellow's preparation for a faculty career; and the fellows' progression through the second year of the program.

During the second stage of coding, specific quotes from the graduate fellows and faculty mentors were grouped into the four categories to establish a better understanding of the underlying themes and the commonalities between them. We then combined redundant codes, discarded uninformative or weak codes, and further described the relationships between the resulting codes. From this analysis, three modified themes evolved, as shown in Table 1.

Table 1. Coding Scheme for GTF Data

Mentoring and Networking	• Peer Mentoring/Networking
	  ○ Working with peers to discuss similar teaching experiences
	  ○ Community building and development
	• "Expert" Mentoring
	  ○ Evaluation from advisor
	  ○ Mentoring practices (feedback)

Preparation for a Faculty Career	• Increase in workload
	  ○ Balancing teaching and research
	  ○ Develop own courses
	• Interpersonal development
	  ○ Confidence
	  ○ Time management ability

Junior Colleague	• Extra responsibility
	  ○ Undergraduate student research assistants
	  ○ Departmental committees
	• Fellows changing identity
	  ○ Changing view of faculty and other students in department

The first theme is the integration of mentoring practices used by the mentor-fellow teams and peer networking amongst fellows, within the community of practice structure of the fellowship program. The second theme covers the degree to which fellows and faculty members felt this program was adequate preparation for a faculty career. The third and final theme reviews the degree to which the fellow progressed from a graduate student to a junior colleague. The following section discusses the assessment results.

IV. Assessment Results and Discussion

A. Mentoring Practices and Community Networking

The first theme that emerged from the interview data was the integration of mentoring practices used by the mentor-fellow teams and peer networking amongst fellows, within the community of practice structure of the fellowship program. Mentoring practices can be discussed in the context of the fellow and mentor relationship, as well as in the context of a peer network or peer community of practice. Additional mentoring was gained through the use of other faculty and students that had or were experiencing similar situations. Mentor and fellow mentoring is discussed first.

1. Faculty-Fellow Mentoring

Each mentor-fellow pair designed their own mentoring practices that were a result of the relationship that developed over the course of the year. Faculty mentors and fellows used a wide

range of formal and informal feedback mechanisms and mentoring practices. All of the fellows cited their mentors' open door policy, and noted that the research advisor relationship made the mentor accessible most of the time. Some mentors provided additional feedback by observing the fellows while they were teaching; one fellow noted the "first semester my advisor sat in once a week and gave me comments." A second fellow had a similar experience with their mentor observing "once a week during the first semester." The fellow noted that during the second semester her advisor "sat in on the first 20 minutes of lab." Mentors generally met with the fellow after the observation, or after their regular research meeting.

Another mentor-fellow pair took the feedback process one step further, creating a feedback journal for use during class observations as a running informal evaluation. The fellow explained that the mentor and fellows shared "a teaching notebook where [faculty mentor] wrote down comments, we discussed what she wrote, and what I could improve on for next time….it was a running evaluation." The faculty mentor mentioned the same practice as an effective method of communication between the fellow and mentor, "I would take notes while she was teaching and we would review that at our meetings. She would keep that as a record." The faculty mentor also commented on items there wasn't enough time to cover during the semester: "I would like to have spent more time working with her in terms of writing test questions. Have her write questions and sit down with her to review those."

Several fellows sought out other faculty members they felt had relevant experience, or had previously taught the course. One fellow even established "a team of mentors", while another "worked with the course coordinator" as well as his teaching mentor. Fellows generally felt that it was good to work with a few different professors, and that there was always "plenty of help available." However, mentors and fellows identified a gap in pedagogy guidance and discussion. While fellows were exposed to pedagogy through coursework taken in the first year of the program, there was little follow on discussion with their faculty mentors.

2. Peer Mentoring and Community

Along with the feedback that was given through formal and informal mentoring activities, many of the fellows would have liked to have more contact with peers in other departments. Several fellows commented that since leaving the freshman program, they did not see the other fellows as often as before and that they would have liked for the program to "continue to keep people involved." Other fellows mentioned how beneficial it would have been to have "met over lunch once every two weeks and said…I'm trying this in class and it works, very informal." Still another student discussed the support from the students while working with the freshman program, she "liked being with other students in other departments and having the same experience and being able to talk with them." She continued to elaborate on the need for more contact with peers, "I thought we were going to have more interaction with the other fellows when I took the fellowship."

Similarly, one of the faculty mentors was concerned about the lack of a "social component of the program", and recognizing the time and effort that the fellows had put in. Other suggestions included having an "end of program social" recognizing the fellows that had completed the program, and to "give the new fellows a chance to meet." Another fellow

commented that although she "didn't feel isolated", more interaction with the other fellows would "help with the sense of community."

B. Preparation for a Faculty Career

Mentored teaching experiences are certainly an important part of preparing for a faculty career, and were the most obvious outcome of the GTF program. However, other aspects of the program, particularly balancing teaching and research duties also served as an important preparation for a career as a faculty member.

Fellow teaching responsibilities varied during the second year of the program for several reasons. Fellows came from a variety of educational backgrounds, which added an additional factor to consider when selecting an appropriate course for the fellow to teach. Coupled with this varied background was the organization of the department to which the fellow belonged. Engineering departments ranged in size from graduating approximately 45 to 200 undergraduates (per year). The size of the department was a driving factor in course offerings every semester, with many departments teaching a given class only once a year. For these reasons, some fellows were able to teach the same course both semesters, while other fellows had to take on a new course at the beginning of the second semester.

Regardless of the course taught, fellows cited a dramatically increased workload over working with the freshman course the previous year. The majority of this workload increase centered on the additional preparation time needed to develop the course materials which had been provided to them in the freshman program. Fellows felt this was such an additional time commitment because of the additional course development responsibilities. One fellow "had to make all the exams and the homework and quizzes, do all of the grading." Another fellow agreed that it was more work because "you're making up all the homework and all of the tests" in addition to preparing for and teaching class several times a week.

Overall, fellows felt that attempting to strike a balance between teaching and research was an important part of preparing for a faculty career. One fellow agreed that "finding that balance is going to pay off so much later." They went on to say that they liked that they "have had the opportunity now in graduate school to figure out time management with teaching rather than when I am in my first year as a new faculty", indicating that while it was stressful and considerably more work, fellows felt that this was a necessary step in their progression towards an academic career. Finding this balance was easier for some fellows than others, for example:

> "Balancing teaching and research was awful. I got up at 4 am on class days, and I had class at 9:30, so from 4 to 9 [am] I would develop some notes and try and get my examples straight. It was still not enough time to make sure that stuff flows right. Four hours was not enough. It's tough to manage that three days a week. On top of that is the grading. The grading was really time-consuming. It's not that I didn't get any research done, but it was hard to focus. Things were done in spurts, a few days here and there."

Faculty mentors were supportive of the way the fellowship program merged teaching and research to create an authentic preparation experience. One said,

> "This has opened her eyes to what's involved. She has some basic learning out of the way that she won't have to do when she becomes a faculty member. She has at least once course prepared when she goes to interview for a job. This forces you to mature rather quickly, it changes your attitude and how you interact with people. This makes you do what you have to do when you graduate, only earlier."

Even with this increased workload and time commitment, teaching fellows agreed, as one stated, "teaching has not affected my graduation timeline, but it has made it harder." Faculty mentors were in agreement as well, stating that each of their respective fellows was on track to graduate at the planned time, and many already had job interviews and offers waiting for them after graduation. One fellow had already used this fellowship to secure a faculty position,

> "The training I received has made the transition to faculty member a much easier one. For a person starting in a tenure track position the idea of obtaining grants and submitting publications as well as doing a good job in the classroom is very daunting, especially in the first couple of years. However, because of this program I'm very comfortable in the classroom and I need much less time to prepare than I did when I first started teaching. This really does make a new job much less stressful. Also, as an aside, I think the program teaches professionalism in the university setting - I know the appropriate ways to interact with students, handle honor code questions, grade questions, etc."

In addition to increased ability to balance the teaching and research workload, both the fellows and faculty mentors alike noticed positive gains in the fellows' interpersonal development. A faculty mentor observed that, "this program has greatly increased his communication ability, the ease with which he speaks to large groups of students, and facilitated his ability to discuss complex subjects with people who may not have the same level of understanding as he." The increased preparation and teaching responsibility has given the fellows confidence in their ability to succeed in academia, which was especially notable in female fellows. One female fellow noted that "this program gave me the confidence to consider teaching as a career." A faculty mentor of another female fellow agreed, saying,

> "I think the impact on [her] has been HUGE. She was very shy, very reserved, did not have a lot of confidence in her own knowledge. The growth and the change that I have seen in her, and everyone has seen in her, she's gone from this shy quiet person to a real leader. She is much more professionally composed. The teaching was what did it, having to be up there and be responsible."

The same female faculty mentor noted the importance of increasing the confidence of female teaching fellows. "When you are a new faculty member you are expected to do research and expected to teach, but you have never had any formal teaching experience. Having the

teaching experience gives student's confidence, which is especially important for women." Participation in this program has also increased the visibility of academic careers. One of the female mentors had "three women PhD students and [current fellow] was the only one who wanted to go into academia. After seeing her teaching, they all now want to go into academia." This increase in efficacy was felt by other fellows as well. One of the male fellows explained, "I have already been in front of a class and had some of the experiences that first year faculty members had. I have had a lot of freedom. I feel I can really sell myself in a faculty position."

C. Junior Colleague

Along with the increase in confidence and sense of preparedness for an academic career, faculty members and fellows alike noticed changes in the level of responsibility that fellows were undertaking. Fellowship responsibilities helped prepare the fellows for faculty positions by giving them increased responsibility comparable to that of a new faculty member. As a part of this process fellows acted-and were treated by faculty-as junior colleagues. Treating fellows like colleagues is important because they are the future stewards of the discipline [13, 17] and should be treated as such. The GTF program assists doctoral students by giving them the discipline specific experience required for training the stewards of the discipline [17] as well as the ability to balance the research demands placed on individuals pursuing careers in academia.

As discussed above, one of the first ways that fellows began to establish their identity as faculty members was to develop more of their own course materials. One fellow had team taught a class with his mentor during the first semester, and was given a new course for the second semester. He noted differences in the relationship between his mentor and himself: "In the second semester I can manage the class how I would like to. When you are working with a senior professor, the class is going to be managed how they want it. It was nice to make my own structure." Overall the fellows agreed that while it was nice to have the initial guidance in the beginning stages of course delivery, they enjoyed the flexibility and ownership of having their own course in the later stages of the program.

As fellows progressed in the program, faculty members not only allowed them more freedom in the course design and implementation, but fellows were also given more general responsibilities within each department. One of the fellows served on the undergraduate curriculum committee and the ABET assessment committee. She felt that this gave her a level of familiarity "with our [department's] overall curriculum, our goals, what we are trying to achieve." Another faculty member asked her teaching fellow to assist her in preparing the material for the ABET review of the course. Yet another fellow commented that her participation in departmental committees caused the "faculty to view me less as a student and more as a colleague." Fellows also noticed differences in the way the department faculty and administration viewed them compared to other graduate students. One noted, "the department let me have the rope to go out there and see what happened, I had already been involved in the department, and I was comfortable talking with the administration. Many other graduate students are not involved at that level."

As the fellows neared the conclusion of their first year working within their home departments, their perceptions of their status in the department changed from that of a graduate student who happened to teach, to more of a junior faculty member:

> "I feel like I am very close to being a faculty member but without the full responsibility…the teaching is a huge thing, but the balancing, the starting to see myself as a faculty member, changed my own vision of how I view myself and balancing my workload. I don't feel overly stressed about adjusting to a faculty workload. Everyone is starting to see me as a faculty member, which is a big mental adjustment."

Many of the graduate fellows also noted that there were research benefits to establishing themselves as effective and responsible teachers. "Through my department trusting me as a teacher ... I was able to take on two undergraduate students each semester...which was a nice benefit for my research progress. They normally don't allow the graduate students to mentor these students as independently." Another graduate fellow was given charge of undergraduate researchers as well. The increased responsibility also gave the fellows a chance to talk to undergraduate students about graduate school. The fellow currently in a faculty position also commented that working with undergraduate researchers, "gave me a chance to talk to undergrads about graduate school. As a faculty member now, it gave me a chance to recruit graduate students." Fellows having the chance to mentor undergraduate researchers not only prepared them for a future faculty career, but demonstrated the level of trust each department had in the fellows. Faculty mentors assigned to the teaching fellows also witnessed the changing viewpoint of the department: "the department was happy to give full responsibility to someone they knew they could trust."

V. Recommendations and Conclusions

Programs that attempt to prepare doctoral students for careers in academia are not unique in their goals. What makes the GTF program different is the attempt to place the fellows in situations common to new faculty. While many programs focus on the teaching aspect of preparing graduate students, arguably an area where most students have less experience, the GTF program has enabled students to find a way to balance teaching, research and other departmental responsibilities simultaneously. The fellows interviewed for this program will be the first cohort to complete a full cycle of the program objectives. Along with the themes that emerged from the program assessment, several recommendations for program improvements were also noted. This section contains recommendations for program improvements, as well as a summary of the important findings and concluding remarks.

A. Recommendations

Along with remarks that are contained in the themes previously discussed, several additional program recommendations were made by fellows and faculty alike. The main recommendations were to establish central coordination at the college level and to increase the availability of networking activities for fellows. These two categories were subdivided into four main recommendations that the current fellows and mentors would like to see implemented,

including: recognition for fellows, formal progress evaluation and feedback, a review of the program structure, and the inclusion of more peer networking activities. A summary of the major recommendations are listed in Table 2.

Table. 2 GTF Program Recommendations

Recognition for Fellows	• Develop a program website • Ceremony or luncheon to conclude program, where fellows, mentors and administration would be in attendance.
Formal Progress Evaluation and Feedback	• Tracking performance assessment • Yearly report on fellows progress • External evaluator similar to freshman program.
Review of Program Structure	• Better interface between the fellowship program and the individual departments • Terms and conditions more explicit to aid in program set up for fellow. • Guidelines to ensure smooth transition between freshman program and fellows home department
Networking Activities	• Continued or professional development events fellows could attend together • Monthly fellow luncheons

In terms of the program structure, faculty and fellows felt that there needed to be a better interface between the fellowship program and the individual departments. Many faculty mentors cited the difficulty in following the "letter of the program" when each department is structured a little differently and has different needs. Another missing element for the faculty mentors as well as the fellows was a formal feedback and evaluation component. A possible solution is presented in the practicum course. Students are required to take a practicum course as part of the certificate program for engineering education (a fellowship program requirement as well). Many of these students take this course during the first year of the program, while they are working with the freshman curriculum. Perhaps something could be arranged to have the students take this during the second year, or encourage students to register for the course during the second year as well? Fellows appeared to have enjoyed the networking activities that were a constant component of the freshman program. Requiring a course akin to Practicum would afford students more peer-networking and community building activities, as well as a source of external formal feedback and evaluation.

In order to accomplish programmatic changes that reflect these recommendations, a GTF program director should be assigned that would be accountable for implementation. This would also serve as a point of contact for departments and faculty that have questions relating to the structure of the program. Overall, the establishment of a fellowship program director and the use of the practicum course in the years following the freshman program address the four recommendation categories.

Aside from the programmatic recommendations listed in Table 2, continued research in the area of student socialization and networking would aid in community development for both the GTF program and engineering departments. A better understanding of the community structure and the various ways fellows interact within their departments and other fellows would allow for program modifications to better meet the needs of future fellows. Increasing awareness of the GTF program may help to augment the presence of engineering education practices within traditional engineering departments. This presence may also assist other universities in modifying their graduate preparation programs or creating new opportunities for graduate students.

B. Conclusions

The aim of this study was to assess the current status of a graduate teaching fellow program with respect to mentoring practices, community, and fellows' preparation for a faculty career. Key findings related to mentoring experience include a wide range of practices used, both formally and informally, as a part of the fellow and mentor relationship. Practices included the more traditional meetings and observations, as well as the more innovative use of a teaching journal. Fellows unanimously felt that they received adequate mentoring from their faculty advisors, but would have liked to have more networking with the other fellows or peers teaching other courses.

With respect to the sense of community on return to their home department, the consensus was that while fellows did not feel isolated, there was a lack of networking and contact with other fellows. Fellows made suggestions for ways to increase this community, which were presented along with the other program recommendations in Table 1. These recommendations included monthly luncheons to establish a sense of community among current and past fellows and discuss current issues the members are experiencing. Another possible solution to the issues of community would be to make the Practicum course a requirement for each semester, which would help establish a formal feedback system as well as an outlet for fellows to interact with freshman program instructors and other engineering education faculty.

Finally we looked at the extent to which this program was successful in preparing graduate students for a faculty career, and could this be improved using a community of practice model. Here the results are twofold; faculty and fellows agree that this program was an excellent preparatory experience for a faculty career, and several aspects of a community of practice were used in mentoring the fellows in their departments. There were however, peer mentoring activities that were not present, that would have added to the fellows' sense of community and ability to gain additional feedback from other fellows.

Most students were unanimous in their enjoyment of the program, both as a rewarding experience and excellent preparation for a future career. A faculty mentor agreed, saying: "I think this sends a clear signal that the college feels that learning how to teach is an important component of PhD education. It was thoughtfully and appropriately done. It is very forward looking."

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Appendix

GTF Program Research Questions (Fellows)

1. How long have you been teaching for the department? What course were you assigned to?

2. What do you hope to get out of being a GTF? Has this motivation changed between the first and second year?

3. What type of workload did you have during the second year? How does this compare with other departments?

4. Do you feel that your GTF responsibilities have increased or decreased in the second year, and why?

5. Did you receive adequate mentoring for your second year teaching assignment? Is there any advice or examples of practices we can tell other mentors about?

6. What were the major differences between the first and second semester during the second year of your GTF program?

7. How do you balance your teaching and research interests?

GTF Program Research Questions (Mentors and/or Research Advisors)

1. Are you a teaching mentor, research mentor, or both?

2. What course is your student working with? Are they working with you to teach the course or with another faculty member?

3. How was this teaching assignment selected?

4. What types of mentoring activities did you do with your student? Do you have suggestions for other mentors?

5. What impact has the GTF program had on _____'s success?

6. What benefits do you see in this program? How might the GTF program be improved?