

Implementing an Engineering Teaching Development Program for Graduate Student Instructors

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Abstract

The Engineering Teaching Development Project (ETDP), a pilot program started by the student chapter of ASEE at the University of Michigan, is a multi-component program designed to improve the long-term teaching skills of graduate student instructors (GSIs) in the College of Engineering. The first component of the ETDP is college-wide pedagogical workshop series. These workshops are conducted by nationally recognized engineering educators invited by the ASEE student chapter. The topics of these workshops include cooperative learning, diversity in the classroom, and classroom assessment techniques. These workshops offer a means of continual improvement for all of the educators in the university, both faculty and GSIs. The second component is the "Departmental Training Programs Workshop," which was held in July before the start of the Fall semester. During this workshop, trained members of University of Michigan's Center for Research on Learning and Teaching (CRLT) helped faculty and graduate coordinators from 8 of the 11 departments in the College develop a step-by-step GSI training program, which could then be implemented in their respective departments. There were also experienced GSIs from each department present at the session. This perspective was helpful for faculty and staff to identify specific need of the GSIs in their department. The final component is the Teaching Fellows Pilot Program. This is a program called for experienced GSIs to submit proposals for innovative approaches to team teaching a course with a faculty member. These proposals should have included a description of the teaching innovation, a description of the assessment techniques used, and identification of the role the mentoring faculty member would play. A selection committee awarded the fellowship to an experienced GSI from the Department of Civil and Environmental Engineering to implement computer-based laboratory exercises in an existing introductory hydraulics course. The primary objective for this three-tiered ETDP project is to provide training and mentoring programs for engineering GSIs that lead to a commitment to educational improvements in the classroom. As a secondary goal, the project seeks to promote an environment in the College of Engineering where continuous improvement of teaching techniques among educators is seen as a standard for those entering academia.

1 Introduction

The student chapter of the American Society for Engineering Education (ASEE) at the University of Michigan (UM) recently established an Engineering Teaching Development Project (ETDP). This program is seen as an integral part of the College of Engineering's increased commitment to teaching innovation and scholarship among graduate student instructors (GSIs). The primary objective of the ETDP project is to provide training and mentoring programs for engineering GSIs that lead to a lifetime of commitment to educational improvements in the classroom. As a secondary goal, the project seeks to promote an environment in the College of Engineering where continuous improvement of teaching techniques among educators is seen as a standard for those entering academia.

The ETDP is funded through a pedagogical grant from the Horace H. Rackham School of Graduate Studies at UM. The goals of the project are accomplished through a combination of college-wide workshops, departmental training programs for new GSIs and an individualized mentoring program. The three tiered approach of the ETDP is intended to reach not only new GSIs, but also experienced GSIs and faculty. This paper outlines the activities of the ETDP over the last year, early assessment results and plans for future development of the project.

2 Pedagogy Workshops

One focus of the ETDP Project is a series of pedagogy workshops held throughout the academic year. In an effort to promote effective teaching amongst faculty and graduate student instructors in the College of Engineering, the ASEE student chapter has organized four workshops featuring nationally recognized engineering educators. These workshops are targeted at all graduate students and faculty in the College of Engineering, with particular emphasis for graduate students who are currently teaching or are planning on joining the professorate. Typically the workshops are interactive, afternoon sessions with approximately 40 participants.

In collaboration with the Center for Research on Learning and Teaching (CRLT) at UM, the first workshop of the series focused on cooperative learning techniques for the classroom presented by Dan Budny of the University of Pittsburgh. In this session, we discussed the purpose of using cooperative learning techniques, how they benefit students in the classroom, laboratory, and in study groups, how they promote active learning, and how they differ from collaborative learning. A meta-analysis of sound research studies has shown that cooperative learning increases real learning, motivation, and retention. Dr. Budny presented a collection of principles to help design cooperative learning experiences that foster teamwork and improved learning. Small group experiences were used to illustrate several of the principles. Overall this workshop was very well received among the 39 attendees. Of the 32 that responded to surveys, all indicated that the workshop was either helpful or very helpful and were very enthusiastic about the quality of the program. When asked what they specifically learned during the session, many attendees responded about the "benefits of cooperative learning" and "techniques for implementing cooperative learning in the classroom." One attendee said: "I learned a lot about cooperative learning and options of how to apply such learning in a field like engineering, which is traditionally competitive." Another identified that "fear of change is usually a main obstacle for

our action” and “cooperation will benefit us more than only individual effort.” “It was great to see the importance of cooperative learning in the engineering workplace-- I think this really needs to be stressed continuously.” Finally, someone commented: “I learned a lot and am excited to improve my teaching.”

For the remainder of the academic year, we currently have three additional ETDP workshops planned. In January, James Anderson of North Carolina State University will present a workshop on diversity in the engineering classroom. Due to engineering’s technical and objective nature, issues of diversity are often treated as a non-issue in the curricula. However discussing and implementing awareness in the classroom is key to training engineers to be productive in a diverse workplace. The third workshop in the series will be a two-day session in March facilitated by Richard Felder and Rebecca Brent of North Carolina State University. They will be bringing portions of their heralded "Effective Teaching Institute" to Ann Arbor for faculty and graduate students in the College. The final workshop for this academic year will be a discussion of classroom assessment techniques presented by Ron Miller of the Colorado School of Mines. Perhaps the biggest aid in improving one’s teaching is continually evaluating its effectiveness. Traditionally this is done through quizzes, exams, problem sets and end of term evaluations, however there are many more techniques that can be easily instituted on a daily basis that provide easily interpreted and instantaneous feedback. These simple and continual exercises can easily improve one’s teaching by quickly identifying problem areas that need to be addressed.

A very exciting and important aspect of the workshop series of the ETDP is the recognition and support we have received from the administration in the College of Engineering. The ASEE student chapter has been approached to co-sponsor the Dean's Seminar Series on Effective Teaching. With financial and institutional support from the College, we are hoping to be able to continue this aspect of the ETDP well beyond the one-year pilot program and build a strong teaching and learning community within the College.

3 Departmental Training Programs

As a second focus of the ETDP, we sponsored a workshop “Enhancing Departmental GSI Development” on July 13, 1999. The workshop was led by facilitators from CRLT. Faculty GSI coordinators, graduate advisors, undergraduate advisors, graduate support staff, and experienced GSIs from each department within the College of Engineering were invited to participate. Through this workshop, the participants gained a greater understanding of the needs of GSIs and the support that departments should provide and developed a strategy for enhancing departmental GSI development.

Over 30 faculty, staff, and graduate students attended the workshop representing 8 of the 11 departments. The program began with a brief introduction of current GSI development programs used by both large and small departments throughout the UM. The facilitators also reviewed resources for GSI development that already exist. This program was followed by a working lunch, during which representatives discussed issues specific for their department. After lunch, everyone discussed common concerns of GSIs and possible means of addressing these concerns.

Finally, the departmental representatives worked as a group to develop a strategy for GSI development.

During the discussion, it became apparent that each department was trying to address many similar issues. Some of the most common concerns were as follows:

- Faculty often neglected to outline expectations and responsibilities of the GSIs; thus, GSIs felt overworked and stressed.
- Teaching development programs, if they existed at all, did not necessarily include training for common tasks such as grading homework, projects, and/or exams, holding office hours, and preparing a lecture.

In addition, participants realized that the concerns of GSIs varied with experience. For example, new GSIs are mostly concerned with departmental policies, returning GSIs are more concerned with teacher centered pedagogical issues, and experienced GSIs are more concerned with learner centered pedagogical issues. Therefore, there is not one type of departmental development program that can address the concerns of all GSIs.

A general consensus was that communication is critical in addressing the concerns of GSIs and improving the GSI development programs within each department. In order to be successful, communication must occur between the GSI and the department, faculty, and peers. Departmental communication includes sharing of rules, regulations, and services and is most important for new GSIs. Faculty communication is necessary to convey expectations, answer course specific questions, and also as a means of mentoring. Another integral aspect of GSI development is peer communication. New GSIs can ask advice of more experienced GSIs and all GSIs can learn from discussions with each other.

Many groups did not have time to develop a complete strategy for departmental GSI development programs, but many common suggestions were made. These suggestions included organizing a GSI luncheon during which the students can discuss successes, ask for feedback, and learn from each other's experiences. Many departments also hoped to develop training sessions that included more pedagogical materials and faculty involvement.

Overall, the participants evaluated the workshop as a success and were glad to have participated. Most commented that the opportunity to discuss GSI development with people from other departments was very helpful in that they could evaluate common concerns and learn from different successful programs. Some participants thought that the experience would have been more beneficial if each department had held a meeting about GSI concerns and development before attending this session. This way, the representatives from each department would be more familiar with concerns from students and faculty before attending this College-wide workshop.

We plan on continuing this program and organizing a College-wide workshop on GSI development annually. We will be conducting a survey of participants in the middle of the academic year to assess the long-term effects of the workshop. We will also survey GSIs in each department to better understand the effectiveness of current development programs. The results from these surveys as well as the workshop evaluations will aid us in developing an even more effective workshop.

4 Teaching Fellows Pilot Program

This part of the ETDP consists of a competitive fellowship for experienced GSIs interested in team teaching a course with a faculty mentor, developing innovative teaching techniques and mentoring less experienced GSIs in the same course. Early in the fall term, experienced GSIs who have obtained candidacy, submitted proposals for innovative approaches to teaching to the Associate Dean's Office. These proposals included a description of the teaching innovation and assessment techniques that would be used, and also outlined the role of the mentoring faculty member. A committee of ASEE members, faculty, and GSIs selected the winning proposal. The GSI, who authored the winning proposal, was then rewarded a fellowship that included \$1500, to be used to develop the innovative materials as outlined in the proposal. The term that the course is being taught, the fellow will receive a 25% GSI appointment from the fellowship.

The goal of this program is to allow for the fellow to take on more of the responsibility for the design and teaching aspects of the course. Instead of merely leading a recitation section, the fellow would have the opportunity to aid the professor in developing the course, such as when and how to use the proposed innovative teaching techniques.

This year, the fellowship was awarded to a graduate student in the Department of Civil and Environmental Engineering. The major part of the proposal is to integrate the use of a software package that would allow the students to do "experiments" on the computer, which through this exercise will allow the students to get a visual understanding of how various parameters found in common equations effect the fluid flow. Additionally, the fellow is intending to introduce a cooperative learning component into the course and develop a course web page.

In its early stages, this program has been successful in that we were able to find a good applicant who is excited about this opportunity. One of the challenges of the fellowship program is publicizing the application process to both graduate students and faculty. Another challenge is financially sustaining the fellowship. We are considering both applying for grants and soliciting corporate sponsorship to fund this program in the future.

5 Conclusions

Over the course of the past year, the ETDP Project has proven to be integral in supporting teaching innovation and scholarship among GSIs. By inviting renowned educators to speak about topics such as cooperative learning, multiculturalism in the classroom, and assessment techniques, we have provided a forum for graduate students, faculty, and administrators to learn about and discuss these educational issues. After the "Enhancing Departmental GSI Development" workshop, GSI training programs have been started or improved in several departments in order to better train and mentor GSIs. The teaching fellowship enabled a graduate student to gain a greater understanding of course development and teaching as well as provided him with an opportunity to initiate an innovative teaching technique and mentor other GSIs. Through the organization of workshops facilitated by recognized pedagogical speakers, the development of departmental GSI training programs, and the creation of the Teaching Fellows Program, the UM student chapter of ASEE has established the foundation for the

improvement of the climate for teaching in the College of Engineering. Due to the success of these programs, the College has invited ASEE to co-sponsor the Dean's Seminar Series on Effective Teaching.

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