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Student-Faculty Partnerships

Abstract

One of the biggest challenges facing new engineering faculty members is finding good students to support research and teaching activities. Often, new faculty are assigned graduate student assistants for research projects or are given TA's from a pool of applicants. Sometimes these working relationships turn out to be productive for both the faculty member and the student, but many times this is not the case. This paper will present a method of identifying students early on in their academic careers and developing good working relationships that are beneficial to both faculty and students.

Over the past five years, students who have done well in lower-level classes have been hired as graders, lab instructors, and – in some cases – MS students. By hand-selecting students and introducing them gradually to the instructor's side of class operations, a new faculty member can be comfortable enough with the students' increasing experience levels to give them appropriate levels of responsibility, either in the lab or doing research. Students who may have an interest in teaching as a career can learn more about the field, gain some experience for a teaching portfolio, and get paid for it at the same time. Students sharing a research interest with the faculty member learn early on about research opportunities with that person. To date, this approach has led to several successful graduate student projects and several more students considering teaching as a part of their career. The paper will provide the views both from the faculty member and from some of the students involved teaching and research projects.

One Week in the Life of a New Engineering Faculty Member

As a new faculty member, you have many demands on your time. Not only are you preparing lectures for one, two, or three classes for the first time, but you are working in a new place with new people at a job where rejection comes more often than acceptance in papers, proposals, and student evaluations¹. You probably spend 20-25 hours preparing for your new classes, and another six to eight hours in class. Add in some set office hours (because you've realized by now that "my door is always open" won't cut it) and you're up to 40 hours before you've done any research. Finishing up a couple of papers from your dissertation? Looking for someone to fund the new project you'd like to start? Behind on browsing through your journals? There go another 15 hours. If you have undergraduate advisees or committee assignments, you'll need another hour or two. Don't have a grader? Four hours. The first few years in a faculty position can take 60+hours out of each week, but finding good student assistants can cut that time significantly and be productive for both faculty and student, on both the teaching and research fronts.

Every new faculty member has probably seen the words "you will be assigned n graduate students to help you with your work" in a startup package or offer for hire. The unspoken disclaimer is that the student or students may not necessarily be interested in your work and they may not necessarily have the technical or personal skills you are seeking in a research or teaching assistant. While these assignments do work out sometimes, other times the students just

find another faculty member who is a better fit, leave before completing their degrees, or create extra work for you because you have to re-grade the papers they mark or debug their computer program for them. Finding students who are interested in and knowledgeable about your work can be a challenge, but by building partnerships with students faculty members can reduce their own workload while providing opportunities for students to gain new knowledge and skills. The process can be either very successful or very disappointing for both the faculty and the students, but it can be an important part of personal professional development for all parties involved.²

Student Viewpoint #1: Melissa Zaczek

My work with Dr. DeBartolo first began with a suggestion to change one of the Materials Science Labs following a recent co-op. On my co-op, I led a project to develop a new outer cover for a baby diaper. This project involved working with non-wovens, a primarily polymer based material with which I had no previous experience. Although my materials classes helped very much in acquiring and performing my job, I didn't feel these classes provided students with enough exposure to nonmetals. The main polymer lab performed in Materials Science Lab involved creating silly putty by cross-linking Elmer's glue. As a student I thought the lab was fun, but not beneficial in understanding the unique properties of polymers and their connection to consumer products. Working with Dr. DeBartolo, we integrated some of my co-op work into the lab, expanding the students' perception of commonly used materials as well as jobs available to them after graduation.

This experience naturally led me to a desire to teach the lab. How better to share my experiences and excitement than to directly present material? After speaking with Dr. DeBartolo about my aspiration, she asked me if I would first grade Materials Science homework to help re-familiarize myself with the course. Grading homework not only helped me brush up on Materials Science concepts, but it further developed my familiarity with Dr. DeBartolo and the other graders. The two other graders continued on with me the following year to become lab instructors. Having worked with everyone previously through grading, I felt very comfortable sharing ideas and soliciting suggestions regarding lab. This sharing of best practices has undoubtedly made me a better lab instructor. Being a lab instructor is a job that has never seemed like work. I love the challenge of having to explain concepts in several different ways. Nothing cements an idea more than having to teach it.

Not only has the position been beneficial to me, but hopefully to also my students. I think the students are more comfortable asking my advice on teachers, classes, and finding a job because I too have very recently faced those same challenges. In presenting material, I try not to forget what it's like to be a student. I integrate the best practices of my teachers, such as giving a brief overview of what we did the previous lab, and what we are going to do this lab, and avoid the pitfalls of others, like not returning labs in a timely fashion.

With RIT's quarter system and alternating co-op blocks, it is sometimes difficult for students to really find a teacher with whom they can truly build a relationship. One may only have a teacher for ten weeks, and then be in a different city for another ten. My experience in working now for over two years with [faculty member] is an exception to the norm, and one I think would be beneficial to more students. Over the years, Dr. DeBartolo has become familiar with my

involvement in extra-curriculars at RIT, likes and dislikes of co-ops, and plans for the future. Knowing about my involvement in outreach activities and desire to teach, she informed me of a grant received in sponsorship of a senior design project. After hearing the project description, designing activities to educate students about engineering and concepts involving energy and the environment, I was hooked. What a great way to tie all of my unique experiences into a capstone project. I am currently the project manager.

Just as Dr. DeBartolo has been able to provide great recommendations to me, I definitely recommend this partnership to other students and faculty.

Student Viewpoint #2: Cory Hoffman

I began working for Dr. DeBartolo as a Materials Science grader during my third year in engineering at RIT. My interest in opportunities with the Materials Science course came after having a student instructor for the laboratory portion of the course the previous year. While my real ambition was to instruct the lab, it was still required that I familiarize myself with the course work and content as a grader before attempting lab instruction.

Grading for the course certainly serves as a refresher for the material content and helps in identifying quality student work over submissions made with less effort. Performing this work as well as assisting in exam grading led to a student-professor working relationship. This was accomplished through various late night meetings reviewing homework assignments or by grading exams around a table with a student-friendly dinner: pizza. Grading also helped me become a better student; I gained an improved understanding of what instructors were looking for in submitted work and therefore I could change my own homework strategy. Finally, after a quarter of grading, my time as a grader yielded to a greater opportunity for me, which was to be a lab instructor for Materials Science.

Teaching for the Materials Science lab involves meeting weekly to go over next week's material and to review proper lab procedures. It also involves, for new instructors, sitting in on another section to observe presentation techniques and lab information. When it came time to teach my very first lab section, all of the preparation seemed to do nothing for my confidence and the realization that someone else's education depended upon me was significant. This realization is cause for extensive preparation and I found myself reviewing notes repeatedly. As time went on, my confidence grew and I developed a teaching style all my own. I enjoyed more and more working with students. Being a student myself, I can identify readily with their learning struggles and adjust my instruction accordingly. I also enjoyed the responsibility that accompanied my position, worked very hard to engage the students as much as possible, and made myself available for questions or lab review. Even in high school I enjoyed working as a math tutor, but had never experienced the level of responsibility accompanying lab instruction and it reaffirmed my passion for teaching so much so that I plan on part-time teaching at community colleges after graduation.

The relationship that I have built up with Dr. DeBartolo over my college career has also helped me personally in being a successful student as well as in preparation for life after college. She has helped me in my graduate work by her ties with an aerospace contractor. By having a

common interest in materials science and a working relationship with Dr. DeBartolo, I had the opportunity to research the topic of diffusion bonding in the hopes of developing an improved process for that company. I also was able to obtain a cooperative position with the aerospace firm where I not only continued research, but also gained experience in drafting and testing in the aerospace field. These experiences and responsibilities that I have had with Materials Science were of great value when interviewing for full time positions after graduation. It demonstrates leadership as well as balance: managing both my work with students and my own personal schoolwork.

For me, my time working with Materials Science has been a very rewarding experience that has helped me to grow as a student. It was a big factor in reaching many of my goals at RIT and the income from instruction is certainly helpful to a student's budget. Nearing graduation, I look back fondly and with gratitude to the experience and enjoy working with the new instructors who will take over future course sections.

Faculty Viewpoint

During my first two years as a faculty member, I taught only lower-division courses: Statics, Materials Science, and Introduction to Mechanical Engineering Design. I was also assigned three graduate students to help with my research and grading. The two research students were not interested in my area of work, and both ended up leaving after completing all or part of their coursework and before they actually did any research. The grading assistant did not have the course background to grade correctly or accurately, and did not want to learn. Fortunately, I had taught several outstanding second-year students in Statics and Materials Science, and I invited all of them to consider working for me in the future as research assistants. Over the next three years, one student worked for me as a grader in the Materials Science course, and he and two others continued as lab instructors for Materials Science. By the time this group of students was finishing their fourth year (out of a five-year program), I knew their interests and strengths and weaknesses well enough that it was easy to find ways to fit their abilities and interests in with my own plan of work. I recruited one of the students to work on a senior design project to develop some equipment for the lab, and all three did either a thesis or MS work for me.

Over the next several years, I built a pipeline of students, starting with 2nd year students who had done exceptionally well in my class. When possible, I hired more graders than needed for my class and allowed students to split the positions. This gave the students the flexibility of alternating weeks if one or more of them had tests or projects due and needed a break from grading. It also gave me a larger group of students from which to draw lab instructors.

I met with the homework graders regularly: weekly to sort the homework papers, review the assignment, and review the grading scheme, and less often to grade tests. To ensure tighter control over the grading of high-point-value exams, I worked together with small groups of graders during one evening to get all tests graded in one sitting. Since this time was above and beyond the typical grading requirements, I usually provided pizza. Not only did these sessions make the test grading go much more quickly, but they also provided a lot of insight into the student view of my department and they let me get to know the students better. After a year of working closely with a group of graders, it has been easy to identify students who might be great

on a research project even if they have no interest in teaching, or students who might not be interested in doing a thesis or research project but have the communication and people skills needed to do well as instructors. In this way, it has been relatively easy to find positions that work for the students and for me.

Lab instructors also met weekly to review the previous and upcoming labs. Since the lab instructors are directly responsible for providing instruction, it was critical to ensure consistency in lab delivery and grading. I required all new lab instructors to attend my lab before teaching one of their own, and I taught the first lab of each week so that any potential problems would come up for me before anyone else. Initially, I continued to grade all lab reports and projects myself to maintain continuity of grading. However, as student enrollment in the lab increased I have gradually offloaded lab grading to the lab instructors and modified the projects to be in-lab presentations. Lab instructors are provided with a detailed grading rubric for all assignments, and there have been no complaints of unfair grading even though the average project and lab grades are unchanged from when I graded all assignments myself. This year, for the first time, I have had a student lab instructor teaching the lead-off model lab each week. Cory Hoffman, the student teaching that lab and one of this paper's co-authors, has worked for me as a grader for a year and is in his fourth quarter of teaching labs; he has more experience teaching the lab now than I did in my second year as a faculty member, and is serving as a role model to the new student (and faculty) lab instructors. Most of the lab instructors with whom I have worked relate very well to their students and have also been willing to make time above and beyond their lab commitment to provide extra help to their students, who sometimes seem to feel more comfortable asking their lab instructors for help than asking the faculty lab coordinator for help. If this brings in students who might not otherwise have come for help, it is a benefit to the class.

Over the past three years, eight students originally hired as homework graders went on to complete thesis projects, senior design projects, or both with me. The result has been one publication accepted, one ready to submit, and a third being written; a new piece of equipment designed, built, and nearly ready to use in lab; a new lab activity, developed by Melissa Zaczek, one of this paper's co-authors; and external funding thanks to connections made through students on co-op. Best of all, outstanding second year students are now coming to me on their own to express an interest in my research and teaching areas, and to ask how they can be lab instructors one day like the student who taught their lab. It has been very rewarding to see what the senior students have accomplished and to see that they have become role models for the underclass students.

Identifying and Mentoring Student Assistants: Suggestions for New Faculty

The most challenging aspects of building rewarding partnerships are identifying student candidates and providing the appropriate support for those students as they develop their skills.

The task of identifying students to work as research or teaching assistants can start as early as the first or second year. While many new faculty members prefer not to teach introductory-level courses, they provide an opportunity to identify students who have good work habits and a thorough understanding of the material you teach. By identifying students early in their college careers, the faculty member also has a span of several years to work with the students, gradually

increasing their levels of responsibility. Outside of class, faculty members have a chance to get to know students assigned to them as advisees or students in clubs they advise; periodic meetings to discuss their future career plans and current course strengths and weaknesses are opportunities to identify those students whose interests fit with research or teaching needs. Students participating in the now-common K-12 engineering outreach activities may already be instructing younger students on technical material, providing an opportunity for faculty members to find students who have a natural ability to communicate well with others.

The second step is working with students to develop the skills they need to work as instructors, graders, or research assistants. It is helpful to build a pipeline through which students can progress and that provide students with increasing levels of responsibility as their skills improve. For example, a student can start out working as a grader with a great deal of supervision and very detailed instructions; after one term, the student may be able to write out homework solutions on his or her own, and after two terms, the student may be ready to start teaching labs. Once a student understands material well enough to teach it, he or she is certainly capable of working on research or design projects related to the course. It is useful to have a feel for the typical student workload in your department. Ask students how many hours it takes to finish their grading or lab prep, and avoid overloading anyone. The result can be disappointing for both the faculty and the student if burnout sets in midway through the term. A student who gets overloaded by a faculty member as grader may fear more of the same when considering whether or not to pursue a research project with that faculty member. Similarly, ask students if there is enough structure in the grading assignments or lab instruction. A student who is left without guidance while grading homework may worry that the faculty member will not provide the support needed for a successful thesis or design project. Most importantly, the faculty member needs to know the students well enough to be able to identify roles and responsibility levels that suit each student. The more you know about the students with whom you work, and their strengths, the more confidence you can have when placing important tasks entirely in their hands.

Summary

While the task of building a professional development program during the early years of teaching and new course development can be stressful, finding and nurturing good students can help to lighten the workload while providing new opportunities for the students to expand their backgrounds. This paper presents viewpoints from one set of faculty and students who have built successful working relationships, and what is presented here may not work for everyone. Other resources are available, either for general student mentoring advice³⁻⁵ or suggestions specific to working with research^{6,7} or teaching^{8,9} assistants.

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