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## **AC 2011-52: STUDY OF A TEACHING PRACTICUM IN AN ENGINEERING PH.D. CURRICULUM**

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# Study of a Teaching Practicum in an engineering Ph.D. Curriculum

## Abstract

The Woodruff School of Mechanical Engineering at Georgia Tech requires all Ph.D. students to complete a Teaching Practicum course during their doctoral studies. Students work closely with faculty mentors in teaching a course. While the focus of the class is on pedagogy, the goal is for students to find the experience useful regardless of whether they are going into academia, industry, a research laboratory, or other career pursuits. In addition to issues dealing with teaching engineering, sessions are organized for career planning, success in both academia and industry, ethics, and basic counseling and mentoring skills. This paper is a study of the effectiveness of the Teaching Practicum experience. Survey responses are analyzed from nearly 100 Ph.D. alumni for the period from the summer of 1996 to the spring of 2009. The results show that the Teaching Practicum class is well received and valued. A retrospective look at the course and lessons learned are offered.

## Background and Motivation

Since the early 1990s, the Woodruff School of Mechanical Engineering at Georgia Tech has required all Ph.D. students to complete three semester credit hours of a Teaching Practicum during the course of their doctoral studies. In the Teaching Practicum, students work closely with a faculty member in all aspects of teaching a course. This includes the preparation and delivery of a limited number of lectures, learning the basics of course design, and administering student assessments and evaluations. The course text is *Teaching Engineering*, by P.C. Wankat & F.S. Oreovicz.<sup>1</sup> A typical syllabus for the course is included in appendix A.

Students and faculty mentors have the latitude to manage expectations in the course and design the learning objectives. While the focus of the class is on pedagogy, the goal is for students to find the experience useful regardless of whether they are going into academia, industry, a research laboratory, or other career pursuits. Guest speakers are organized throughout the semester. In addition to issues dealing with teaching engineering, sessions are organized for career planning, different drivers underlying success in both academia and industry, ethics, and basic counseling and mentoring skills.

The hypothesis of this paper is that the Teaching Practicum is useful to graduates regardless of whether they enter academia, industry, or take other career paths. A study of a similar program at Georgia Tech was published in 1998.<sup>2</sup> This current study provides a retrospective look at the course and offers lessons learned.

## Conduct of the Study

A web-based survey was sent to 321 former doctoral students who graduated from the Woodruff School of Mechanical Engineering from the summer of 1996 through the spring of 2009. A copy

of the survey is provided in appendix B. Ninety-nine responses were received for a response rate of 30.7%.

## Results

### Helpful in Academia

The first question in the survey asks whether the Teaching Practicum has been helpful to the respondents in their position in academia. Table 1 shows the results.

strongly agree	agree	neutral	disagree	strongly disagree	respondent not in academia
19.1%	23.4%	3.2%	2.1%	0.0%	52.1%

Table 1. Teaching Practicum has been helpful in my position in academia.

Most of the narrative comments were positive for this question and primarily addressed the helpfulness in teaching. The practicum was cited as useful in developing teaching notes, preparing homework and exams, and the delivery of lecture material. One respondent found the practicum a “small but illuminating window into the world of teaching engineering.” Another felt the course was “invaluable to [my] success as an educator. Several respondents also found the experience particularly valuable for improving their interpersonal, presentation, and general communication skills.

Feedback for improvement often cited a desire to do more teaching as part of the course. Individuals stated that they would have preferred being more involved in the teaching portion and delivery of content, rather than grading and leading problem solving sessions. Regarding preparation for an academic career, one person cited that there was not enough coverage of defining and developing research plans.

There were several insights listed in the narrative input to this question. A couple of individuals cited that it was revealing how much preparation time and effort is required when teaching a course. One person found the Teaching Practicum the “most valuable course at Georgia Tech.” Another felt the Teaching Practicum was a “point of competitive advantage for GWW [Woodruff School of Mechanical Engineering] students seeking academic positions.”

### Helpful in Industry

Question two of the survey asked about the helpfulness of the Teaching Practicum experience in their position in industry. The results in Table 2 are shown below.

strongly agree	agree	neutral	disagree	strongly disagree	respondent not in industry
6.5%	37.7%	13.0%	2.6%	0.0%	40.3%

Table 2. Teaching Practicum has been helpful in my position in industry.

Respondents in this area most often found the Teaching Practicum experience useful in improving their communication skills and their ability to prepare and deliver presentations. One

person noted that this was particularly true in communicating complex topics to diverse audiences. In summary, perhaps the most revealing comment was that “The skills that facilitate good course lectures are also relevant in industry presentations at conferences and in house.”

The only comment toward improvement in this area was that more coverage should be given in the Teaching Practicum toward what engineers with Ph.D. degrees do in industry. An interesting insight was that the course experience helped the respondents understand how other technical people think.

#### Helpful toward general Professional Development

Respondents were asked if the Teaching Practicum has been helpful toward their general professional development. Table 3 lists the results.

strongly agree	agree	neutral	disagree	strongly disagree	not applicable
25.3%	53.2%	12.7%	0.0%	0.0%	8.9%

Table 3. Teaching Practicum has been helpful toward general professional development

Once again in this area, individuals cited the helpfulness of the Teaching Practicum in helping them develop interpersonal, communication, and presentation skills. It was also noted that the experience helped them build confidence in communicating to audiences.

#### Retaining the Teaching Practicum as a Ph.D. requirement

Table 4 shows the results of whether the Teaching Practicum should be retained as a Ph.D. requirement in the Woodruff School of Mechanical Engineering.

strongly agree	agree	neutral	disagree	strongly disagree	not applicable
55.6%	35.8%	4.9%	0.0%	0.0%	3.7%

Table 4. Retaining the Teaching Practicum as a Ph.D. requirement

Overwhelmingly the Ph.D. alumni felt that the Teaching Practicum should be retained. It was felt to be of benefit to Ph.D.s academia or industry by helping them become adept educators. Participants gain confidence from the experience and it helps to ensure professionals graduate from the Woodruff School. A couple of the respondents felt the course should be expanded.

One suggestion was that the course might better cater to both academic aspirants and industry aspirants. Another person was not sure whether the Teaching Practicum should be a requirement for those students not contemplating a career in academia.

#### Most useful topics

The following lists the Teaching Practicum topics that survey respondents identified as most useful and the number of times these comments were cited in the narrative feedback for this question.

Teaching Practicum most useful topics	# times cited in survey narrative responses
Preparation and practice of teaching techniques; developing course materials	25
Success in academia: academic hiring process; expectations of academic faculty; tenure-track process; grant proposal writing	16
Understanding various learning styles; educational philosophies	12
Interacting directly with a faculty mentor	5
Forum for discussion with peers/fellow Ph.D. students	3
Presentation skills; presenting technical material	2
Classroom issues: student interactions; dealing with harassment; dishonest students; etc.	2

Table 5. Teaching Practicum most useful topics

#### Topics not covered that would have been useful

The following lists topics not covered in the Teaching Practicum that respondents thought would have been useful, and the number of times these comments were cited in the narrative feedback for this question.

Topics not covered that would have been useful	# times cited in survey narrative responses
Obtaining research funding; writing grant proposals	5
Expectations of academic faculty; tenure-track process	5
More coverage of industry and research lab positions, outside of academia	4
Understanding various learning styles; educational philosophies	4
Student interactions; dealing with dishonest students	3
More lecture preparation	1
Using technology and web resources	1

Table 6. Topics not covered that would have been useful

#### Conclusions and Recommendations

Overall the feedback from the Woodruff School Ph.D. alumni on the Teaching Practicum experience was very positive. Only a couple of respondents out of nearly 100 did not find the course useful.

In general, the Teaching Practicum course was found to be more useful to those individuals entering a career in academia than to those planning to enter a career in industry. But the most positive result of the survey was that the overall experience was helpful towards individuals' general professional development.

The authors agree with a comment from the survey results that the Teaching Practicum provides a competitive advantage to the mechanical engineering doctoral degree at Georgia Tech. The

consensus opinion appears to be in retaining the current topics in the course. Consideration should be given for adding a session(s) on obtaining research funding and preparing grant proposals. Also, since many graduates do not enter academia, more coverage could be spent on additional topics from industry and other career paths.

#### Bibliography

1. Wankat, P.C., Oreovicz, F.S., *Teaching Engineering*, McGraw-Hill, Inc., 1993.
2. Norris, Pamela M., Palmer, Sheila C., *Effectiveness of the Woodruff School Doctoral Teaching Intern Program*, *Journal of Engineering Education*, Volume 87, No. 3, 1998, pg. 223-226
3. Lowman, Joseph, *Mastering the Techniques of Teaching*, 2<sup>nd</sup> Ed., Jossey-Bass Publishers, San Francisco, 1995.

## Appendix A

# GEORGIA INSTITUTE OF TECHNOLOGY

THE GEORGE W. WOODRUFF SCHOOL OF MECHANICAL ENGINEERING

## ME/NRE 7757: Teaching Practicum

### Information

**CATALOG DESCRIPTION:** Supervised teaching for doctoral students. Teaching techniques, course and curriculum design, student evaluation methods and criteria. Students in some instances prepare and present lectures.

#### Requirements to get a Satisfactory grade in this course

Attendance Requirement ... maximum of three absences from the lecture portion of this course.

Practicum Requirement ... you give three lectures / demonstrations with your Teaching Mentor present.

Note: It is your responsibility to ensure that you get feedback from your faculty mentor / someone who is NOT a student in the course you are teaching AND feedback from students who are taking the course (you may use the forms included in this handout).

#### Required Assignments

Assignment 0 ... Setting your goals and learning objectives.

Assignment 1 ... Querying your teaching mentor ... Why did you decide to become a professor? What are the responsibilities of a professor? What do I wish to learn from this experience? What will I be doing to achieve what I wish to learn?

Midterm Progress ... Assignment 2.

Show and Tell ... Assignment 3.

End of Semester Learning Essay ... Survey and learning.

#### Note on the Practicum

Teaching mentors have the freedom to organize the practicum aspect of this course. Hence, there is no one model that is endorsed – all are valuable in their own way to the extent that they enhance your learning experience. Students have undertaken the following activities in consultation with their mentor:

- Prepared and given three or more lectures
- Set and graded one or more homework sets
- Set and graded one or more exam questions
- Attended a significant number (if not all) of the lectures
- Counsel students wrt the course material
- Created demonstrations that could be used in class

To ensure that you invest your time productively it is important for you to establish your learning objectives soon. It is critical that you, in consultation, with your Teaching mentor work out what activities you will be undertaking as part of the practicum portion of this course. I have asked you to clearly identify these in Assignment 1.

#### Material

Wankat, P.C., Oreovicz, F.S., “Teaching Engineering”, McGraw-Hill, Inc. 1993.

You can download the book from the following website

[https://engineering.purdue.edu/ChE/News\\_and\\_Events/Publications/teaching\\_engineering/index.html](https://engineering.purdue.edu/ChE/News_and_Events/Publications/teaching_engineering/index.html)

#### Teaching Practicum Expectation - Student / Professor

Each of you is working with a professor in offering a course. Discuss what you wish to learn from the Teaching Practicum with your professor. Aside: You are expected to offer at least three lectures during the semester with the professor present and it is expected that the professor will help you prepare these lectures and also offer you constructive feedback. At the end of the semester I will be asking you to complete an end-of-semester survey.

## Syllabus

I am also going to solicit a midterm report and a commentary vis a vis your learning from the practicum portion at the end of the semester from your teaching mentors.

1. Course Overview.
2. Teaching Tips – *Christine Valle*  
See text. Chapter 1 - Teaching Engineering. Chapter 3 – Designing your First Class. Chapter 6 – Lectures
3. Goal setting and learning objectives. The Observe Reflect and Articulate Construct, See text. Chapter 15 – Learning Theories.
4. Dealing with large classes. *Tom Sanders*.
5. Town Hall Meeting – Questions and Answers.
6. Setting and grading exams.  
See text. Chapter 11 – Testing, Homework and Grading
7. Writing proposals and getting funded ... academia and industry ...
8. Globalization: Impact on Career  
Reading: The World is Flat Afterall – Thomas Friedman
9. Career planning: Preparing your job application. See Text – Appendix A: Obtaining an Academic Position. Page 348.
- 10. Experiences of a novice instructor ... sharing experiences ... donuts in the park ☺**
11. Advice for the doctoral student and budding academician – *Bill Wepfer*  
See text. Appendix A – Obtaining an Academic Position.
12. How to be successful in industry and academia... different drivers underlying success in academia and industry – *Richard Salant*  
See text. Chapter 17 – Professional Concerns
13. Break-out groups ... mentoring, motivating and inspiring: selecting people to work with, motivating people, dealing with difficult situations and ethics ... break-out groups ...  
See text. Chapter 12 – Student Cheating, Discipline and Ethics. Chapter 10 – One-to-One Teaching and Advising.
14. An Educated Engineer in Society – *Jon Colton*
15. Thanksgiving.
16. Summary and End of Semester Submission.

### FILE NAMING CONVENTION

ME7757.xx.yy where xx is an acronym for the assignment/submission and yy your family name.

Examples:

ME7757.A0.

Assignment 0 from xxxx for ME/NRE7757.

ME7757.EOS.

End of Semester submission from xxxx for ME/NRE7757.

### OTHER

Please ensure that your name and assignment number appear within the Word file. Please ensure that the pages are numbered.

When communicating with me on other matters please include the following in the Subject Header: ME7757 – Meaningful Words – Family Name

### Contact Information

I want to help you succeed. I love to talk ... please feel to stop by, call, email, etc.



## Appendix B

### Georgia Tech Woodruff School Teaching Practicum Survey

1. The Teaching Practicum course that I completed as part of my Ph.D. studies at Georgia Tech has been helpful in my position in academia:

strongly agree	agree	neutral	disagree	strongly disagree	not applicable
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Narrative input:

2. The Teaching Practicum course that I completed as part of my Ph.D. studies at Georgia Tech has been helpful in my position in industry:

strongly agree	agree	neutral	disagree	strongly disagree	not applicable
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Narrative input:

3. The Teaching Practicum course that I completed as part of my Ph.D. studies at Georgia Tech has been helpful toward my general professional development:

strongly agree	agree	neutral	disagree	strongly disagree	not applicable
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Narrative input:

4. Regarding the Teaching Practicum course, I would recommend retaining the Teaching Practicum as a Woodruff School Ph.D. requirement:

strongly agree	agree	neutral	disagree	strongly disagree	not applicable
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Narrative input:

5. What topics did you find particularly useful from the Teaching Practicum?

Narrative input:

6. What topics were not covered, but you would have found useful from the Teaching Practicum?

Narrative input: