

# **Teaching an Undergraduate Engineering Class for the First Time**

**Aravind Kailas and Sandra S. Courter**

**College of Engineering**

**University of Wisconsin-Madison**

## **Abstract**

Many international graduate students in engineering departments are hired as teaching assistants to teach a course at the undergraduate level as their first college teaching assignment. Many new educators (international graduate students like me) are often unfamiliar with the specific engineering body of knowledge in an assigned course and the learning style of the students. The international student community usually comes from various engineering disciplines. Making a good first impression and establishing a rapport with the class is of utmost importance. Teaching assistants are faced with various options during their preparation for the course and the whole experience is very rewarding. Limited publications based on direct experiences in teaching an engineering course for the first time are available. My experience as a teaching assistant for an undergraduate electronics circuits course in spring 2003 semester at the University of Wisconsin-Madison is the example used in this publication. This paper describes a first teaching experience from the point of view of an international graduate student (and experimenting with presentation tools and techniques). Recommendations for teaching an undergraduate engineering course based on classroom experiments are also made throughout the paper.

## **Introduction**

The term teaching assistant (TA) is an umbrella term used by the Government to describe paid permanent or contract staff employed in a variety of functions in support of teachers in Graduate schools. Teaching assistants make important contributions to student learning<sup>1</sup>. Many international graduate students in engineering departments are hired as teaching assistants to teach a course at the undergraduate level as their first college

teaching assignment.

This paper uses my teaching experience as an example. I was assigned to teach an ECE undergraduate level titled Circuit Analysis (ECE 230) in the spring 2003 semester at the University of Wisconsin-Madison. There were 48 students in my class. All of them had either freshmen or sophomores standing in their departments. They were from various engineering disciplines such as Electrical and Computer Engineering, Mechanical Engineering, Civil Engineering and Biomedical Engineering.

For many international TAs, teaching an undergraduate course and being responsible for student learning is probably a new experience altogether. I learned how to teach an engineering class by observation in the many engineering classes I took at the undergraduate and graduate levels. Most graduate students may not have taken a class which emphasizes how to teach an engineering class. At the University, I attended the New Educators' Orientation prior teaching my first engineering class. This two-day training prepared me for what is expected of a teaching assistant on day 1. The typical duties of teaching assistants and the roles they play in student education were covered. International graduate students, in the field of engineering are often unfamiliar with the specific engineering body of knowledge in an assigned course, as they may not have any direct experience or they may have been exposed to the field in a different environment. As a new educator, I received a syllabus from the professor who often teaches this course. The engineering department typically selects the course textbook for the assigned graduate teaching assistant. I found it was very useful in designing my own syllabus for my discussion classes.

### **Know Your Students**

The classroom is diverse not only in terms of the engineering disciplines students come from, but also in terms of gender, ethnicity and nationality. It is vital to come to terms with this fact and be aware that the learning styles of students may differ. A good teacher must wrestle with the issue of quantity of content to be covered versus the depth of students' learning, and must learn to optimize teaching hours. It is very important to know your students to make such decisions<sup>1,2</sup>. A useful technique that will assist in learning the students' names and more about them is to collect some basic information. In the very first class, I asked my students to fill out on a sheet of paper some basic information about them. It may include (1) name, (2) preferred name, (3) email address, (4) hometown and state (country), (5) major, (6) class (Fr., So., Jr., Sr.), and (7) class expectations. This information helped me learn about my students and their expectations. At the end of my first class, I also asked my class to fill out a questionnaire on the teaching style, pace of the lecture and the teaching aids used and suggest changes, if

necessary (as shown in Table 1). This feedback meant that I could design, adapt, or adjust context to suit my students' needs right from my second class.

### **Decide on a Teaching Style**

During my discussion hours (within the first month of classes), I taught similar concepts to the same batch of students using two styles of teaching: the traditional approach, that of explaining the concept and assigning an application of the concept; and the problem-based learning approach. Statistics targeting student-learning and student comfort at grasping the concepts were collected. The students were asked to vote, rate and comment on the teaching styles. The feedback and the assessment techniques were documented and shared with the students and the faculty advisor<sup>2</sup>. It is very important for the teacher to establish a good rapport with the students and one of the easiest ways to do this is by continuous feedback from the students. Such simple experiments can go a long way in creating an atmosphere conducive to student learning. One can also try to make the discussion session as relevant to the audience and therefore, lay emphasis on the practical applications<sup>2</sup>. This approach especially could work well in elementary courses, for example a course on electronic circuits is one class where you can always cite day-to-day applications of the concepts. This also makes the class more interesting!

- 
- Rate the teaching style on a scale from 1 to 5
  - Rate the pace of today's class on a scale from 1 to 5
  - Rate the relevance of the discussion class to the regular class on scale from 1 to 5
  - Why would you attend this discussion hour? (your expectations from every class)
  - How can this lecture be improved to help you learn the subject?
- 

Table1. Sample Assessment Questionnaire

### **Presentation Techniques**

I mainly used the chalkboard and an overhead projector. The chalkboard is very good for demonstrating basic calculations such as homework, quiz, and exam solutions. I found that the students would write when I wrote on the chalkboard. It is also a good tool for

presenting an overall picture or main concept of each topic. When using the chalkboard, printing letters and numbers large and neatly helped. Clearly labeled circuit diagrams or flowcharts to approach numerical problems also helped the students. Based on some results collected during my classroom experiments, 85% of the students understood a concept (or had a better understanding of the behavior of an electrical gadget) better when they could associate the equations with a graph (or a physical entity). The more complex or abstract the material becomes, the more helpful are relevant illustrations. I found that students had no problems reading my handwriting. Sometimes, an overhead projector was used at the beginning of each lecture to present outline, graphics, definitions, examples, or tables related to that class. As an international engineering graduate assistant, I was also aware of some changes to my English language diction. By consciously speaking slowly and clearly I tried my best to reach out to the students. I also used a lot of graphics in class. My students found these techniques were very helpful. My teaching experience exposed me to the real environment of teaching.

To conclude, I gained a better understanding of the engineering topics that I taught. In summary, this experience helped me and will help other graduate students prepare for the professorate. Teaching a course is important for graduate assistants who want to pursue a career in academia.

## **Bibliography**

1. McKeachie, W. J., *Teaching Tips: Strategies, Research, and Theory for College and University Teachers* (11th ed.), Boston, NY, 2002.
2. Vesilind, P. A., "Mentoring Engineering Students: Turning Pebbles into Diamonds," in *ASEE Journal of Engineering Education*, vol. 90, no. 3, July 2001, p. 407- 411.

#### ARAVIND KAILAS

Aravind Kailas is an Engineer at QUALCOMM Inc. since 2004. His research interests include teaching as research (TAR) and assessment of student learning. At UW-Madison, where he earned his Master of Science in Electrical Engineering, he was an award-winning teaching assistant and also served as the Chairperson of the Teaching Improvement Program for the College of Engineering; *E-mail:* [akailas@uwalumni.com](mailto:akailas@uwalumni.com).

#### SANDRA SHAW COURTER

Sandra Shaw Courter is Director of the Engineering Learning Center and a member of the Department of Engineering Professional Development, College of Engineering, University of Wisconsin – Madison. Her area of research is engineering education including assessment of student learning. She teaches technical communication courses to undergraduate engineering students. She earned her Bachelor of Science degree in English Education and her PhD in educational administration here at UW-Madison. She has been involved with several NSF proposals; *E-mail:* [courter@engr.wisc.edu](mailto:courter@engr.wisc.edu)