Insights & Ideas for Teaching & Learning

a publication of the Oakland University Senate
Teaching and Learning Committee

Winter 1997 Vol. 9, No. 1

Ed. Note: For this issue, we have the opportunity of reading insights on teaching from the winner of the 1996 University Teaching Excellence Award at Oakland University: Andrew Rusek (who also illustrates how he discovered the fountain of youth!). At the end of his interesting article is a request for opinions that hopefully will indicate how many faculty members believe that the method of evaluating teaching needs changing (and also how many faculty read this newsletter!).

Teaching Electrical Engineering Courses Through Interactions with Experiments and Computer Simulations

by Andrew Rusek, Professor at the School of Engineering and Computer Science

Closer contacts with the University Senate Teaching and Learning Committee during the process of nominations for the Teaching Excellence Award of 1996 brought many interesting reflections into my mind. Some of them I am able to share in this article with my colleagues. I would also like to express my thanks to the many people who in various respects helped in shaping my teaching abilities, and to those who helped me come to Oakland University. The School of Engineering and Computer Science has had three of our faculty members awarded with the Teaching Excellence Award over the last 10 years, and I feel very happy and honored to be one of them.

I would like to present here the teaching ideas I have followed throughout my professional career without planning or special preparation. The teaching techniques are byproducts of the ideas, and they may change with development of new technologies of presentations.

I have taught many electrical engineering courses for more than thirty years. All courses, particularly at Oakland University, have included regular class lectures, weekly laboratories with practical experiments, analytical and synthetical projects, and tutorial sessions. These course components have required very close synchronization, integration, and continuity of information flow in order to create a uniform but flexible structure that can be continuously modernized. I have learned over many years that every one of us should be a teacher, a researcher, and a student. The research problems of today become the educational topics of tomorrow.

Thanks to my broad research and engineering experience (and a lot of luck in finding and working with the many professionals from whom I could learn), I have developed close links among three basic layers of engineering subjects: mathematical description, physics of the phenomenon, and numerical illustrations. These links are missing in most available textbooks so many students feel that my lectures and models of different engineering problems (supported by many practical demonstrations) enhance their ability to work in the laboratories at Oakland (and later in industry or at other institutions).These three basic links have been supplemented by integration of theory, computer simulations, and practical experimentation, and by the presentation of all these components together during my lectures and laboratory experiments. For instance, I place a major emphasis on obtaining practical results in assigned projects, and I find it useful to compare the findings of practical experimentation with theory and simulations.

Over many years, I have followed several general principles that I learned very early in my professional career: the first is competence; the second is a continuous search for the best methods to motivate students to develop their creativity; and

the third is impartiality or fairness to students and colleagues.

"I avoid multiple choice tests and quizzes. They do not develop the desired levels of creativity that 'essay' types of problems do."

My competence in engineering has not come from taking courses, nor from reading books and articles. Engineering practice, broad industrial and scientific research carried out at several research and educational institutions in several different countries, and working with astronomers, physicists, geographers, and medical doctors have added new dimensions to my electronic communication and instrumentation background.

My research has been paralleled with part-time or full-time involvement in teaching. I must admit that I have not found any better method to motivate my students than by sharing my own ways of solving engineering problems and my own ways of problem interpretations.

One other simple but important idea has been to make the students aware that my goals in teaching coincide with their goals in learning. My students should know that what they learn and how much they learn is important to me. In striving to achieve this goal, I try to be available to the students who need help by attending many of their laboratory and project sessions and by trying to work with them individually well beyond my regular office hours. I believe that it is in our professional best interest to assist students and give them the best knowledge we can.

There is no absolute reference to be applied to follow the fairness principle (unless teachers and students were robots, and grades were determined solely by multiple-choice exams). However, I have discovered that application of a "human face" to formal solutions can actually create a better atmosphere which I have found yields improved learning results.

Engineering, like many other disciplines, could be taught in several ways. The most effective way, perhaps very unattractive, is an old fashioned lecture with the writing of all derivations and examples on a board (sometimes enriched by overhead projector illustrations of more complex schemes). I must say I like it. As mentioned before, I incorporate practical experiments that are demonstrated in the classroom, and I bring a computer to show how to solve engineering problems by applying software simulations and comparing results with practical measurements performed during demonstrations.

Describing my teaching techniques, I know that I may antagonize my friend, Max Brill, who wrote an excellent article on teaching that appeared in this newsletter in the Winter of 1996. Although I have several hundred pages of my undergraduate class notes with examples and problems for each subject I teach (and although I give my students most of them), I do not bring them to the lectures to look at myself. My lectures exhibit a lot of flexibility. Within the general framework of the subject matter, many variations can occur. The notes, examples, and new problems either exist in some part of my memory, or they can be reconstructed in the class due to my long-time involvement in solving many engineering problems.

Teaching engineering courses can cause many stresses and frustrations. This fact is especially true because many balancing compromises must be made: to balance the amount of information I would like to convey to my students and the very short time devoted to education; to balance all relevant aspects of theory and practice; to balance engineering and technology; and to balance analysis and design. All these issues are considered in preparation of lectures, experiments, projects, tests, and final examinations.

My tests always include some ideas that the students have to develop based on their previously acquired knowledge. Old tests and their solutions are disclosed to new generations of students, and this situation forces me to design new problems for the tests and introduce changes in other course components. I avoid multiple choice tests and quizzes. They do not develop the desired levels of creativity that "essay" types of problems do. The interim semester tests (usually three) lead to a final examination which is comprehensive. The style of the final exam resembles the spirit of the previous test and the students are ready to face it (usually

more so than for the prior tests). I grade all projects, homework assignments, tests, and final examinations myself. However, the laboratory experiments are graded by a Teaching Assistant (TA) who is given very detailed instruction related to the grading policy and formal grading scale.

The grading policy is disclosed to the students very early during the semester, and it leads to slightly depressed grades after the first test (i.e., a "bear" market in grade inflation), but, as the final examination approaches and more work is done (including projects and other short-term assignments), grades become more "bullish". The average grade of the class is not fixed. The "depression" cycle in grading takes care of the average by itself. The statistical approaches do not work in grading the groups of 25 or 40 students I normally teach. The students who do not perform too well drop the class very early during the semester (so that they have enough time to concentrate on other courses); or if they feel they could improve, there is always some flexibility in the grading process to accommodate positive changes. The grade component distribution encourages students to work hard until the end of the semester.

I have had the chance of introducing three new graduate courses to Oakland University since 1985. The most popular of them, Instrumentation and Measurements, has been taught at OU five or six times, and eight times at General Motors, over the last six years. This would not be possible if I did not work at OU where teaching efforts are highly appreciated by many faculty members and students.

In preparing new subjects that have never been taught at Oakland, I spend a lot of time creating and testing laboratory experiments and practically verifying existing theories and models of different phenomena I try to discover myself. I must "feel" the material, not only reproduce it from available sources (at this stage, I am also initially evaluating different textbooks). Often, I enrich the planned experiments with computer simulations applying software that I use in my research projects. Sometimes, I write software myself to illustrate effects which could not be exposed by other programs. Based on that, I write laboratory instructions for each experiment. Graduate projects (included in my regular courses) are usually carried out in industry (in comparison to undergraduate projects, which are designed like larger laboratory experiments) and presented at Oakland University by the end of the courses, so that my efforts are limited to the detailed technical advising. The final stage of preparation involves writing the class notes for a course, a final decision on the choice of the textbook, and selection of other sources of information for students.

Preparation of an "old" subject does not differ, in principle, from preparation of a new one. Modernization of old experiments, addition of new units, addition of new technologies, and preparation of new problems and projects are necessary to maintain sufficient compatibility with industrial world progress.

To achieve teaching goals more generally, I have been very successful as a member of two small teams in obtaining funds supported by the Oakland University Foundation and the Electrical and Systems Engineering Department to purchase new equipment for our laboratories. Our two proposals were received very well, and we were able to modernize our basic departmental laboratories. I converted my office into a laboratory so I could work on many experiments more efficiently and faster.

When I work on some research at industry I often see my current and former students in industrial laboratories and offices. Oakland University engineering students design airplanes, cars, tractors, phones, TV and radio sets and transmitters, computers, entertainment devices, medical equipment, safety and environmental protection equipment, military hardware, material processing machines, and many other important items. Many former student names escape my memory but they remember me. Often they phone me up to ask about certain professional issues they want to learn, or sometimes they just want to come back to the University to study more and acquire higher degrees. Thanks to them, after so many years of work with students, I feel younger.

****

Improving the Evaluation of Teaching

In the prior issue of this newsletter, I indicated a possible need to change the way teaching is evaluated in order to encourage good teaching. I have received many positive oral comments from faculty on this issue, and I hope to be able to generate additional comments here

(which might be useful in developing new ideas and helping push needed changes through the proper channels).

Oakland University faculty are generally extremely competent, and our students are generally well-motivated and intelligent. In such a situation, educational excellence should thrive.

However, as I indicated in my prior article in this newsletter, evaluating teaching almost exclusively through the use of student evaluations can have a very counterproductive effect on the rigor and quality of education. The motivation provided by such a system of evaluation is for faculty (consciously or subconsciously) to meet student short-term wishes (or demands) for easier courses and higher grades. After all, students are not robots seeking solely to increase their knowledge, but they also have personal lives, time constraints, and goals other than learning (including career goals that may require a diploma and good grades). Although I do not advocate overworking students, the current method of evaluating teaching has a disastrous effect on higher education and the value of a diploma by encouraging faculty (in the competition for higher student evaluations) to offer higher grades and less and simpler assigned study (although some teachers take an elitist approach of discouraging weaker students with "impossible" work and exams early in the semester, in order to motivate them to drop the course and thereby "purge" the class of students who might complain on evaluations later).

Human students should be allowed the opportunity to express their longer-term view on the value of their education and teachers. By incorporating alumni evaluations into the process of evaluating teaching, teachers will be more motivated to concern themselves with students' long-term best interests (and will be less motivated to be concerned solely with satisfying the short-term wishes of good grades, more free time, and a diploma). A greater concern for the long-term best interests of students will also enhance incentives for faculty to teach concepts and skills that are valued long-term, including in many areas in which colleges are currently found to have lots of room for improvement (such as in teaching communication skills and developing students' abilities to solve ambiguous problems that have unclear answers, that frequently have more than one good answer, and that often take a great deal of thought and creativity).

Some try to defend the current method of evaluating teaching by stating that students are our "customers" whom we must satisfy at all costs (i.e., "the customer is always right," even if "the customer" just wants to "buy" a diploma). However, this argument ignores the fact that most of our university's funding comes from the state (and other non-student sources), and the state requires us to act as an institution of higher learning (instead of as an organization that seeks to satisfy "customers" in return for tuition dollars).

But even considering the students as mere "customers" to be "satisfied" is inconsistent with using student evaluations almost exclusively to evaluate teaching. As an analogy, would it be rational for car manufactureers to ask car buyers about their satisfaction with a car only before they have had a chance to drive the cars? No, a car is a long-term investment, and car buyers should be asked their opinions about the product long after it is bought (even if the number of responses is low). But then, some student evaluation fanatics might retort that education is merely a short-term service to provide entertainment to students, and so there is no need to ask students their long-term opinions on that "entertainment" (since it has no long-term use).

I would like to poll faculty on this issue here in order to help justify further discussion of it at relevant committees or forums. As a result, for those who believe that the current method of evaluating teaching should be improved, I would like to request that you please send me a statement indicating such. The statement (or other comments and criticism) can be sent by campus mail to Austin Murphy (at 502 Varner Hall), or by EMAIL to jamurphy@Oakland.edu

Thanks, Austin Murphy

****

Editorial Information:

***Insights & Ideas* is published twice a year by the Oakland University faculty Senate Teaching and Learning Committee, Office of Academic Affairs, Oakland University, Rochester, MI 48309-4401. The newsletter is distributed free of charge to Oakland University faculty. Letters, news, and requests for additional copies should be sent to the address given above.**

-Austin Murphy, Editor