First Year Faculty Classroom Observations

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Abstract

As a first year professor, it is often difficult to juggle the duties associated with the academic world and to successfully prepare and disseminate quality information in the classroom. This paper identifies several teaching techniques implemented and some observations from the naivete viewpoint of a professor during the first year of teaching. The lessons learned by students and the professor from implementing structured controversy and team learning techniques are discussed. Additional observations of the professor are noted on topics such as exam development and classroom dynamics.

Introduction

The engineering classroom presents many challenges to an excited and academically inexperienced new professor. The transfer from an industrial setting to an undergraduate teaching institution, such as Mercer University, initiates and demands one to instantaneously evaluate and redefine personal and student expected long and short term goals. A new professor experiences many personal and professional challenges. Typically, relocation is involved which always invites stress. But primarily, the drastic alteration from industrial manager to university professor can be quite daunting. As a manager, the focus is typically on the success of one or many long-term project goals and with the manipulation of project team members to insure efficient and effective project completion. The new faculty member inherits three or four new course preps, student advisees, committee assignments, and a variety of other odd jobs. In general, such tasks involve the completion of short-term goals and activities. Personal gratification and a sense of accomplishment must now be recognized through the successful preparation (however painful) and delivery of a 1-hour lecture. This differs vastly from the goals associated with multi-year projects typically associated with the industrial consultant. Success is now measured by the successful dissemination of technical material and with the students ability to interpret how this material is used by practicing engineers. Described below are some of the teaching methods and results (both successful and dreary) used and experienced by a new faculty member. Topics such as structured controversy, team building, test performance, and classroom dynamics are discussed.

Observations and Discussion

Structured Controversy

With great expectation, the process of structured controversy (debating) was introduced into the classroom. The process involved dividing in half an Air Pollution class filled primarily with senior level Environmental Engineering students. The two groups consisted of only three or four members and were instructed to devise opposing arguments surrounding the global warming issue. Half the class was to effectively argue that global warming is occurring, while their classmates will insist that such a phenomenon is man’s faulty interpretation.

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of data. Prior to the debate, pertinent technical issues such as global warming, greenhouse gases, and the ozone layer were discussed in class. Students were then instructed to collect and scrutinize information supporting the side of the argument assigned to them. The following items were learned by the student debate participants.¹

1. The technical issues surrounding global warming were mastered.

2. Effective argumentative communication skills were learned and practiced. Such skills are invaluable to an engineer in the work environment.

3. It is important for engineers and scientists to accurately report technical information to the general public. The ability to communicate technical ideas to the non-technical community is essential to success.²

4. It is often difficult to decipher between propaganda and scientific fact.

5. The press uses propaganda to manipulate public opinion.³

6. Conclusions drawn from scientific data can be manipulated by only showing a portion of the results.

**Problem Day**

As a wrap up to defined sections of technical material, a class period was commonly used for problem solving. Students worked in self-appointed, informal cooperative learning groups of two to four individuals.⁴ Although the students recognized that the successful or unsuccessful completion of these problem sets did not significantly affect their grade, they tended to use this class time effectively and diligently aspired to master the new material. This exercise further developed the student’s problem solving, communication, and group working skills. Additionally, in this informal setting, even the most timid of students were more apt to ask the instructor for further explanation on the more difficult subject matter.⁵ Although no substantial data is available after just one year of instruction, it was observed that students performed above average on exam questions dealing with similar technical issues as those covered by in class problems.⁶–¹⁰

**Homework Teams**

At the beginning of each semester, the instructor formed heterogeneous homework teams each consisting of two to four students.⁷–⁹, ¹¹, ¹² The students were given, in writing, a detailed set of rules for their team. A brief summary of team rules is provided in Table 1. The students were strongly encouraged to meet to work on problem solutions. To help enforce this idea, the instructor refused to give help to an individual that had not previously discussed problems with their team members. Each homework team turned in only one set of solutions for each assignment.

At the end of the semester, in order to receive a grade for homework, each student was required to complete a questionnaire. The form requested comments on the homework team concept and implementation strategy as well as required them to grade (0 to 100 percent) the performance of their team members.¹³ The average grade assigned by the team members to an individual was then multiplied by the team average homework grade. This became the homework grade for the individual team member. This grading scheme was used as a tool to encourage each student to participate and contribute to group assignments. The questionnaire also provided student feedback detailing their perceptions of the homework team concept. The students were also requested to suggest modifications to improve the process and were given this opportunity to openly criticize the homework team concept.
**Test and Quiz Development**

To the inexperienced professor, designing a test that is “fair”, that can be administered in a 50 or 90 minute time frame, and that adequately covers the course material is a daunting task. Several experiences that occurred are shared below.

The biomedical and environmental engineering students at Mercer University are required to take both a sophomore level thermodynamics course and a senior level course that combines upper level thermodynamics with heat transfer. During the first several class periods of the senior level course, the material from the sophomore year is reviewed. This review of material caused many of the students to profess boredom and to proclaim that they had a full understanding of the material. These comments prompted the instructor to administer a pretest to evaluate the student claims of subject mastery. Although the pretest did not count toward the final grade of the students, they were instructed that they had to take and give full effort on the exam to pass the class. So, all students did take the exam but put minimal to no effort into studying and reviewing the material. Results from this pretest activity influenced how this course and others were taught.

The pretest consisted of four questions that students should have been able to solve after the successful completion of the sophomore level thermodynamics course. The senior level class contained 32 students and the average pretest score was 42.7 percent with a standard deviation of 17.2. As a result of these scores, the students became more compliant to reviewing thermodynamics. At the conclusion of the thermodynamics section of the course, the students were required to retake this same exam (pretest). After the review and covering advanced thermodynamics for an eight-week period, the class average score on the same exam significantly improved to 73.5 ± 13.6. All students showed an increase in average test score. Again, the instructor acknowledges that although the students were compliant and did attend class in order to take the exam, it is anticipated that few students, if any, actually studied.

The pretest exams were not returned to the students. But, the instructor did share the class averages and encouraged students to come by during office hours to discuss their exams and to ask any technical questions concerning the exam. Surprisingly, only one student inquired about their specific performance on the pretest and requested help understanding one of the test questions. The inquiry occurred after the first time the exam was administered. No one asked questions after the exam was administered the second time. To a new instructor this was baffling behavior and led to many questions. How do we create an environment such that our students want to learn, want to be creative, and are inquisitive? Why is learning fun and exciting for some individuals, while others only want to learn what is necessary to get by? As instructors, how do we stimulate those students with great minds? Such concepts leave a new professor extremely puzzled.

One of questions on the final exam for the thermodynamic and heat transfer course was borrowed from the pretest. Fortunately, as a result of the student-initiated review associated with final exam preparations, overall class performance on this question improved. Figure 1 provides details of class performance on this problem on the three exams.

The environmental engineering students at Mercer are also required to take a course in air pollution during their senior year. On the first examination administered during the Fall 1998 semester, the instructor asked a conceptual question concerning air pollution concentrations. To answer the question correctly, no calculations were required. The solution to the problem was simply a single number that was given in the problem statement. Unfortunately, student understanding of this concept was poor which translated into a poor overall class performance on the exam question. When the exams were returned to the students, the instructor carefully discussed the solution. The review involved explaining the concepts, giving the correct answer to the question, and providing the exact page in the required text for further reading. This same question was repeated on both the second and final exams. Although performance on the question improved, some students were still unable to successfully grasp the concept and answered the question incorrectly. Figure 2 details the average student score on this exam question.
Comparison of data from Figure 1 and 2 suggest that student understanding of technical material was enhanced when the instructor conducted an in class review of exam solutions and concepts at the time the tests were returned. Students performed better on the same question on future exams if in class reviews were conducted. Furthermore, it was noted that valuable information regarding student understanding of concepts could be obtained by evaluating student performance on individual test questions. The information can be used to identify difficult technical subjects and then the understanding of the topics can be supplemented through further class discussions and by assigning additional homework problems.

**Classroom Dynamics**

For a new professor, understanding the dynamics associated with each class is a formidable task. It was anticipated that classroom dynamics would vary as a result of size. But, it was puzzling why some classes interacted freely with the instructor while others were quiet regardless of prompting. Furthermore, why was the interaction from some classes very positive while other classes provided only negative comments? How could the negative energy of a few individuals control the dynamics of the entire class?

As a new faculty member, it was inconceivable that classroom discussion centered on technical or ethical issues could be a disturbance. So, during the instructor's first semester, the students were encouraged to participate in classroom discussions and an informal atmosphere was created to promote this idea. As a result, most students comfortably asked questions in class and in the professor's office. It was perceived that this open environment encouraged the development of the critical learning skills of the students.

Unfortunately, this approach was used during the professor's second semester of teaching. On the first day of class, the instructor encouraged the students to actively ask questions and to share relevant examples to discussion topics during class. As expected, this created a positive environment in two of the three courses taught by the new professor. But, in the third class, it was discovered that a small handful of disrespectful students were able to insure no communication in the classroom between students to the instructor. Unfortunately, if comments were allowed in the classroom, several students quickly initiated inappropriate conversations showing great disrespect to the instructor and to their classmates. Such dialog frequently contained violent references. As a result, the instructor disallowed classroom conversation and unfortunately the students could not participate in classroom active learning and team building techniques.

**Final Remarks**

A new instructor has much to learn and many avenues of teaching styles to investigate. For example, there are a variety of exciting teaching tools available through the advancement of digital technology and the Internet. And furthermore, although not necessarily high tech, starting to improvise the traditional chalk board teaching schemes with some proven techniques such as instructional controversy and building team skills through team learning can quickly enhance the academic experience for both the student and professor. Although the learning curve is steep for the new professor during their first several years at a university, many hard lessons are learned along the journey. Learning to effectively instruct students in all classroom settings regardless of the dynamics associated with student interactions and individual personalities can be difficult. Furthermore, by reviewing performance on exams, the instructor can focus on subject areas students' find difficult to master.

**References**


Table 1. Homework Team Structure and Guidelines.

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<th>Membership</th>
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<td>1. The Instructor will establish team membership.</td>
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<td>2. Teams will usually consist of three students.</td>
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<td>3. Your team membership is not subject to change. You may not “resign” from your assigned Team.</td>
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<td>4. While you cannot resign from your assigned Team, you can be “fired”, if in the opinion of all other team members, you are not carrying your share of the work or do not attend Team meetings.</td>
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<td>5. If you become a “fired” team member, you must immediately (before the next homework assignment), find another team which will be willing to accept you as a member.</td>
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<td>1. Only one solution set will be turned in for each homework Team.</td>
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<td>2. <em>It is strongly suggested that all Team Members meet physically to prepare their Team solution.</em></td>
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<td>1. All Team solutions will be submitted on the date given by the instructor.</td>
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<td>2. A single grade will be earned for each team’s solutions. All team members will receive this grade.</td>
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<td>3. An individual that is “fired” from two teams will receive a zero Homework grade for the Course.</td>
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<td>4. At the end of the course, each team member must complete a Questionnaire/Team grade report to receive a Homework grade. In the Team Grade Report team members will grade all team members (including themselves) on the quantity/quality of participation for the Team Homework process. The average of this grade will be multiplied by your overall team homework grade.</td>
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Figure 1. Student average score on the same question given on three different thermodynamic examinations during the same semester. The students were never given the answer to the exam question during the formal classroom setting. Students were encouraged to ask instructor about exam problems not understood well during office hours.

Figure 2. Student average score on the same question given on three different air pollution examinations during the same semester. After both the first two exams, the students were given the answer to the problem plus additional concept information during the formal lecture period.
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