

Application of the ExCEED Approach in the Classroom

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The American Society of Civil Engineers (ASCE), the United States Military Academy (USMA) and the National Science Foundation (NSF) have joined forces to improve the quality of teaching in the Civil Engineering departments across the country. There are several statistical evidences that a large percentage of students that start as civil engineering majors change their program before graduation. One of the main reasons cited for this exodus is the quality of teaching. In an effort to attract, retain and graduate civil engineering students, USMA, ASCE and NSF have been offering two week long short courses during the summers of 1999, 2000 and 2001. These short courses are titled "Excellence in Civil Engineering Education (ExCEED)." About 24 professors are selected from across the country for each session.

This approach emphasizes six main points: list of objectives, board notes, class interaction of students with professors, use of models, variety of teaching techniques and collaborative learning. These approaches were utilized in my classes and at the end of each semester, a questionnaire was given out to the students and survey them about the usefulness of the more detailed list of class objectives and group quizzes. Also during my classes, models, audio-visual illustrations were used. After my attendance to this workshop, my student evaluation climbed from below average to above average within the department.

Freshmen and sophomore students better appreciated the list of objectives than upper level students. The board notes helped me to organize my lectures, exam preparation and use of the board. The student-teacher interaction was more difficult to implement and make students participate on a continuous basis. As the class moved forward, fewer students participated willingly. When students were pressured, they tended to respond negatively. But one of the most successful techniques that worked in the classroom was the group or team quiz. As professors, we learn that certain topics or concepts are harder to be understood by students, and then the group quizzes were very successful for students to explain and teach each other and also generated fewer papers to grade. In the questionnaires, also the students responded positively about the group quizzes.

Introduction

The American Society of Civil Engineers (ASCE), the United States Military Academy (USMA) and the National Science Foundation (NSF) have joined forces to improve the teaching skills of Civil Engineering faculty across the country. The model for teaching and learning according to this workshop are to provide orientation, to provide learning objectives, provide information, stimulate critical thinking about the subject, provide models, provide opportunities to apply the knowledge, asses the learners' performance and provide feedback, and provide opportunities for self-assessment. The main reason is that 41% of students switches their initially chosen major in engineering and 98% of these students cited poor teaching as the contributing factor (Seymour and Hewitt, 1997).

The ExCCEd workshop is a very intensive two week faculty training program. The attendees are divided into teams of four along with their respective mentors. The workshop includes presentations of teaching techniques, class demonstration using the technique and the participants application of the techniques learned at the workshop. In an effort to attract, retain and graduate civil engineering students, USMA, ASCE and NSF have been offering two week long short courses during the summers of 1999, 2000 and 2001. These short courses are titled "Excellence in Civil Engineering Education (ExCEED)." About 24 professors are selected from across the country to attend each session.

This approach emphasizes six main points: list of objectives, board notes, class interaction of students with professors, use of models, variety of teaching techniques and group learning. These approaches were utilized in my classes of Civil and Geological Engineering courses. At the end of the semester a questionnaire was given to the students asking them about the usefulness of the more detailed list of objectives and group quizzes. Also during my classes, models, audio-visual illustrations were used.

Objective

The main objective of this study was to determine the opinion of the students with respect to the implementation of the lessons learned at the Summer 2000 ExCEED workshop. The group quizzes and detailed class objectives were selected to be evaluated due to the fact that it is easier to be carried out in the classroom environment. The group quizzes were focused to increase group and collaborative learning and indirectly to increase the interaction among students and the instructor. It serves as an opportunity to pose critical thinking or higher level questions to be solved in a collaborative way.

Methodology:

Group Quizzes

The group quizzes consisted of 1 or two questions to be completed in 5 to 10 minutes for classes that lasted for 50 minutes. They were given an average of 5 to 10 quizzes per semester. In Foundation Design, the quizzes were administered mainly during lab time and these quizzes were longer and required a deeper analysis. Usually the questions were selected from topics that the students found difficult in previous semester exams or projects. Students were asked to pair or triple at most to solve the problem. Many times these quizzes were open book and open notes. Each group submitted one quiz for grading. In occasions, some students preferred to work independently. The result of the test also served as a good indicator of their understanding of the topic. In several occasions, these group quizzes provided me with a quick and direct feedback that alerted me the shortcomings of the class. Therefore, I used it to clarify some of the weak points encountered in the class.

One of the examples for illustration purposes would be to determine the hydraulic gradient in a permeability test setup. Students are able to use Darcy's equation, but a geometric deviation from the typical permeameter illustrated in textbooks or in class

might become confusing to students if they do not understand very well the concept. But if the student has a good grasp of the concept, he or she will answer it correctly, no matter how the permeameter set up is arranged.

The questionnaires were given out after they finished their final exam. They were told that these questionnaires are not part of an evaluation, but to determine their opinion about the group quizzes and detailed course objectives. The questionnaire was titled “ASCE EXCEED TEACHING TECHNIQUES EVALUATION.” Six statements were listed related to group quizzes and they were as follows:

1. It allowed me to teach or explain to members of my group
2. I was able to learn from my group members
3. It helped me to get feedback from my group members about my understanding of the subject
4. All group members participated to solve the quiz
5. I was given group quizzes in other classes at NMSU
6. I prefer to take individual quizzes

The above statements could be answered with choices were very similar to the ones in class evaluation. These choices ranged from strongly agrees, agree, no opinion, disagree and strongly disagree. The objective of the six statements that were used in the survey were to determine if there was interaction and collaborative learning. Question one was used to determine if the student contributed in the team effort by teaching or explaining to his or her team members. Question 2 was to determine if he or she was able to benefit from this interactive and collaborative learning. Question 3 looks at if the students got feedback from their group, which either reinforced his understanding of the topic or clarified misunderstandings. Question 4 was used to determine if the group members participated actively or they were passive observers leaving the thinking and solution of the problem to certain individuals. Question number 5 was to determine if this type of quizzes were administered in our campus. The last question was to determine if the students preferred to take the conventional and individualized quizzes.

Initially the students appeared to have difficulty in talking to another student, but afterwards it becomes a habit that they just pair off with another student. Many students in the senior level class, where the quizzes were longer, they distributed the work among their members. These groups finished their quizzes very fast and many times they helped other groups to solve finish the assignment. The ultimate goal of the group quizzes is to make the students learn.

Class Objectives:

The class objectives were listed on the board before the class began in Foundation Engineering and Geohydrology. These courses are senior level courses and most of the students are in their last year or semester. On the other hand, in geology for engineers, most of the student are freshmen, sophomore and some juniors. The class objectives were provided chapter by chapter and given out after an exam or when we completed the lessons. The words used in the class objectives were: explain, describe, calculate, design, define, etc. as suggested by professors at the workshop. In the class objectives questionnaire, there were five statements and they were as follows:

1. The class objectives before class allowed me to focus on the given topics
2. The list of objectives helped me to prepare for the exams
3. The exams were in accordance with the list of objectives
4. Instructor should continue listing class objectives
5. The syllabus is a sufficient list of course objectives.

Results

The results of the survey were analyzed class by class every semester. The course of Geology for Engineers was surveyed for two consecutive semesters. On the other hand Foundation Design was surveyed only one semester. The results were ranked as 4 points for strongly agree, 3 points for agree, 2 points no opinion, 1 point disagree and 0 for strongly disagree. According to this ranking with respect to question 1 for group quizzes, 18% of surveyed students strongly agreed with the group quizzes. Seventy percent agreed and only less than 10 percent that they had no opinion (Figure 1). The result of the survey that were taken for two course and different semesters were analyzed jointly. The results of the composite result indicate the strongly agree increases, but agree declined 10%. The net effect of strongly agree and agree do not change. The percentage of students without opinion remained less than 10 percent (Figure 2). When students were asked about taking individual quizzes, about 65% disagree and strongly disagree.

With respect with list of class objectives, also in the course of Geology for Engineers and with respect to question 1, about 12% strongly agreed, 82% agreed and 8% disagreed (Figure 3). More than 80% of the students agreed and strongly agreed to be given a more extensive list of class objectives. When the results of both courses and both semesters the answers in strongly agree increases, but decreases the percentage in agree. The choices of no opinion and disagree increases to 30%. About 70% of the students in different classes and semesters prefer to be provided with a more extensive list objectives than the syllabus (Figure 4).

References

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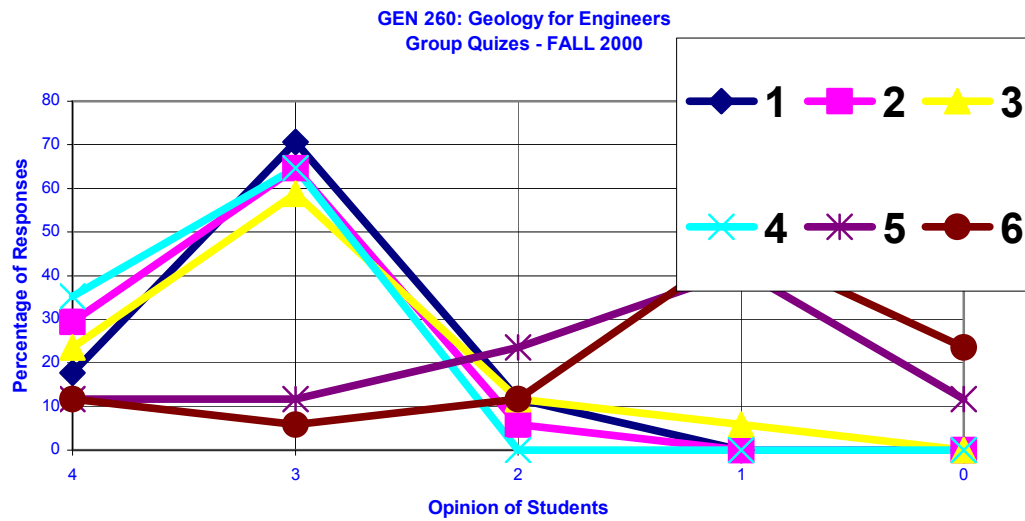


Figure 1. Percentage of students that strongly agree, agree, no opinion, disagree and strongly disagree with respect to group quizzes in Geology for Engineers.

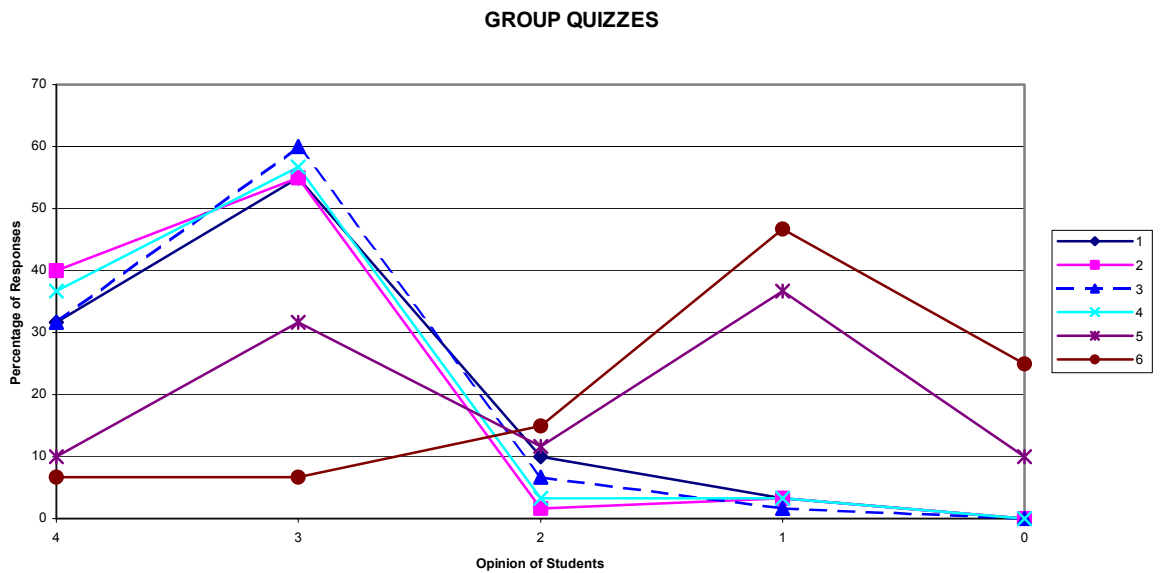


Figure 2. Cumulative percentage of students that strongly agree, agree, no opinion, disagree and strongly disagree with respect to group quizzes representing three classes and two semesters.

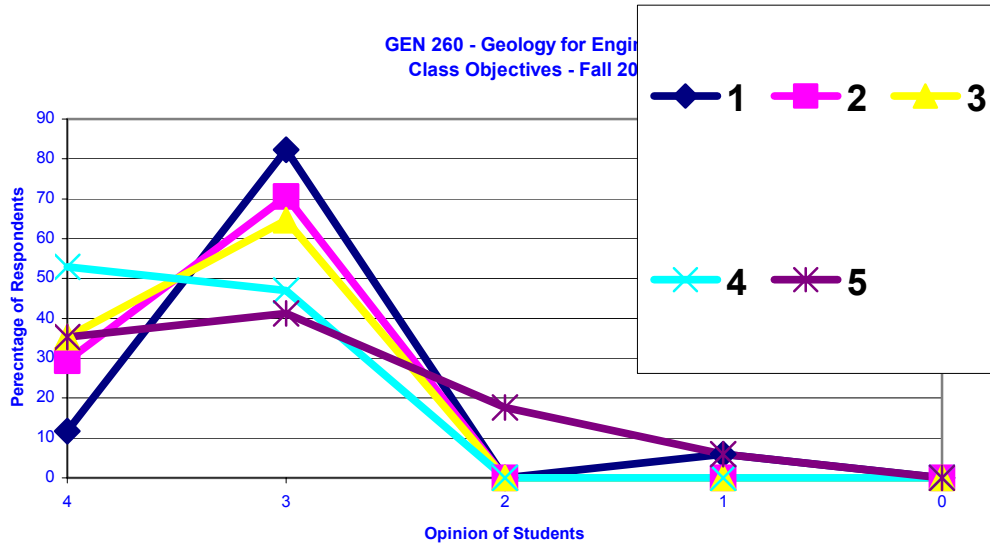


Figure 3. Percentage of students that strongly agree, agree, no opinion, disagree and strongly disagree with respect to more detailed list of class objectives.



Figure 4. Cumulative percentage of students that strongly agree, agree, no opinion, disagree and strongly disagree with respect to more detailed list of class objectives from three classes and two semesters.

