

## Teaching Assessment: How Do You Do It?

Allen C. Estes and Stephen J. Ressler  
United States Military Academy

### Introduction

The role of the teacher in the classroom carries tremendous responsibility. A group of students that can range from a half dozen to several hundred are depending on that individual to provide structure to a body of knowledge, to guide the learning process, to convey difficult subjects in a clear manner, to lead the classroom and out-of-class activities such that student time used efficiently, and to provide a course of instruction where the students can successfully complete the learning objectives. And somehow, the teacher is supposed to establish some rapport along the way. How does the teacher know when he or she is doing well? And how does someone who oversees a program know that the teachers who work for him are doing well? This paper attempts to answer these questions using many of the tools available at the United States Military Academy as illustration.

### What Constitutes Good Teaching

Before teaching can be assessed, one must first answer the question what constitutes good teaching. Seymour and Hewitt<sup>1</sup> interviewed hundreds of math, science, and engineering students and were able to quantify what students considered bad teaching. The list was long and included such things as inadequate preparation, preoccupation with research, inability to communicate, presenting material at too high a level, and not understanding how people learn. If all of the student comments were turned from a negative to a positive, it would be a good list of what constitutes good teaching. The ExCEED (Excellence in Civil Engineering Education) Teaching Model<sup>2</sup> shown in Fig. 1 is used in the ASCE ExCEED Teaching Workshops to define what constitutes good teaching. The ExCEED Teaching Model is derived predominately from Lowman's Two-Dimensional Model<sup>3</sup> and Wankat's Compendium of Learning Principles<sup>4</sup>.

The ExCEED model recognizes both the need for structure and organization as well as rapport with students and an enthusiastic, engaging presentation. The learning objectives have to be clear and the student needs frequent and timely feedback against which to measure progress and make adjustments. Different students learn in different ways and instructors need to appeal to those different learning styles. Technology in the form of computer simulations, software demonstrations, PowerPoint slides, video clips, overhead slides and even chalk can enhance instruction as long as it is used appropriately. This is one list that defines the aspects of good teaching; others undoubtedly exist. If the model is valid then one can then assume that if a teacher is doing everything on the list, he or she is probably teaching well.

**The “ExCEED Teaching Model”**

- **Structured organization**
  - Based on learning objectives
  - Appropriate to the subject matter
  - Varied, to appeal to different learning styles
- **Engaging presentation**
  - Clear written and verbal communication
  - High degree of contact with students
  - Physical models & demonstrations
- **Enthusiasm**
- **Positive rapport with students**
- **Frequent assessment of student learning**
  - Classroom assessment techniques
  - Out-of-class home work and projects
- **Appropriate use of technology**



*Teacher  
as  
Role  
Model*

6

Figure 1: The ExCEED Teaching Model<sup>2</sup> Used in the ASCE Excellence in Civil Engineering Teaching Workshops

### Individual Faculty Member Teaching

The Civil Engineering program at the United States Military Academy has several tools available to assess the teaching performance of an individual faculty member. These include:

- Student Ratings
- Student Performance
- Course Assessment
- Time Survey
- Peer/Mentor Assessment
- Classroom Assessment Techniques
- Self-Assessment (Faculty Training)

The institution has a standardized set of questions that every student completes for every course at the Military Academy (A1 to A6, B1 to B3 on the next page). The individual department can add questions (C1 to C12) and an individual course can add questions, often pertaining to how well the student felt he or she met the course objectives. The questions, which relate to instructor enthusiasm, organization, communication, depth of knowledge, concern for learning, and timeliness of feedback all connect directly to the ExCEED Model. If the students react positively to all of these questions, one can rightly assume that the students feel that the quality of teaching is high.

**USMA Level Questions:**

- A1. This instructor encouraged students to be responsible for their own learning.
- A2. This instructor used effective techniques for learning, both in class and for out-of-class assignments.
- A3. My instructor cared about my learning in this course.
- A4. My instructor demonstrated respect for cadets as individuals.
- A5. My fellow students contributed to my learning in this course.
- A6. My motivation to learn and to continue learning has increased because of this course.
- B1. This instructor stimulated my thinking.
- B2. In this course, my critical thinking ability increased.
- B3. The homework assignments, papers, and projects in this course could be completed within the USMA time guideline of two hours preparation for each class attendance.

**Department Level Questions:**

- C1. In this course, my instructor served as a professional role model for cadets.
- C2. My instructor demonstrated depth of knowledge in the subject matter.
- C3. My instructor demonstrated enthusiasm for teaching and for the subject matter.
- C4. My instructor had a structure or plan for every lesson's learning activities.
- C5. My instructor helped me to understand the importance and practical significance of this course.
- C6. My instructor used well-articulated learning objectives to guide my learning.
- C7. My instructor communicated effectively.
- C8. My instructor demonstrated that he or she cares about my learning.
- C9. My instructor demonstrated positive expectations of the cadets in the class.
- C10. My instructor used visual images (pictures, demonstrations, models, diagrams, simulations, etc.) to enhance my learning.
- C11. My instructor gave me timely and accurate feedback on my learning progress.
- C12. In this course, the exams were fair and relevant.

The questions are answered on a scale of 1 to 5 where 1 represents “strongly disagree”, 5 represents “strongly agree” and 3 is neutral. The numbers for an individual instructor offer a nice snapshot in time, but they are placed into context when compared to the rest of the department and the rest of the institution. Fig. 2 shows the results from the institution level questions for an individual instructor relative to the other instructors in his course, the CE division, the rest of the department (C&ME), and the institution (USMA) as a whole. In addition, the surveys are repeated year after year (Fig. 3), so an instructor can track his or her performance over time to establish trends of improvement and identify areas where more effort may be needed.

A second area where teaching can be assessed is through student performance. Certainly grades are one measure, but students can be surveyed as to how comfortable they feel with respect to each of the objectives in a particular course. The student data is obtained through the same end of course survey. The course director makes his own independent assessment as to how well the students met the objectives. These results are presented as part of the annual course assessment process that is done for each course in the civil engineering program. Fig. 4 shows the partial results for CE400A the Civil Engineering Professional Practice course. The student data over several years is compared to what the instructor assesses student understanding to be. In this case, the

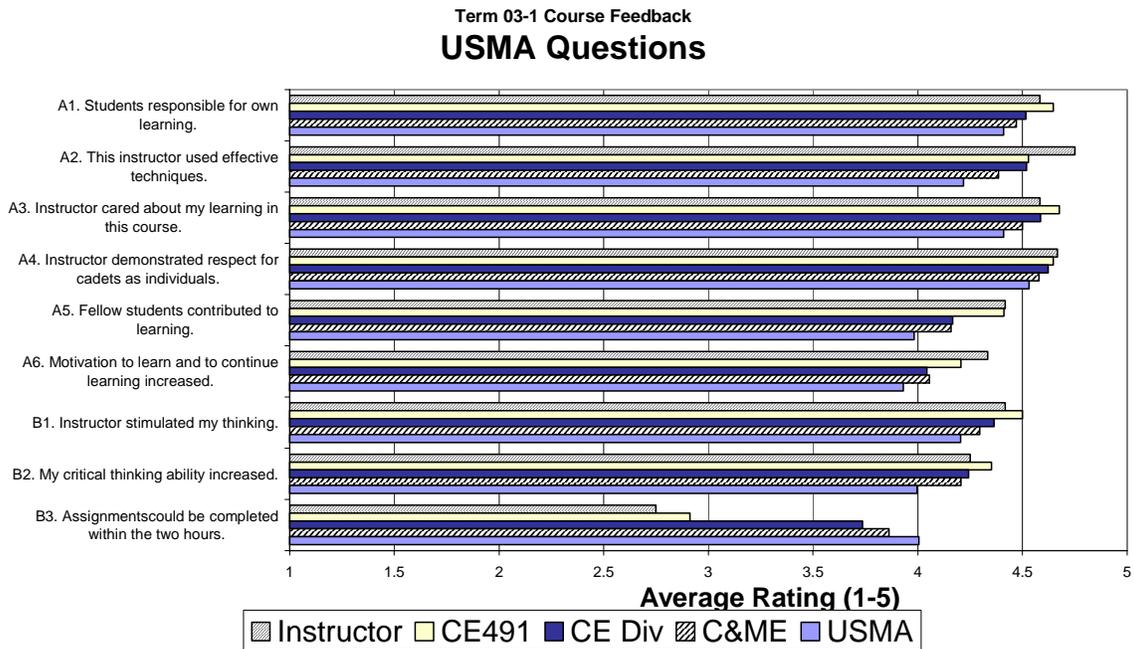


Figure 2: Individual Instructor Ratings Compared Against the Average Ratings of Larger Groups

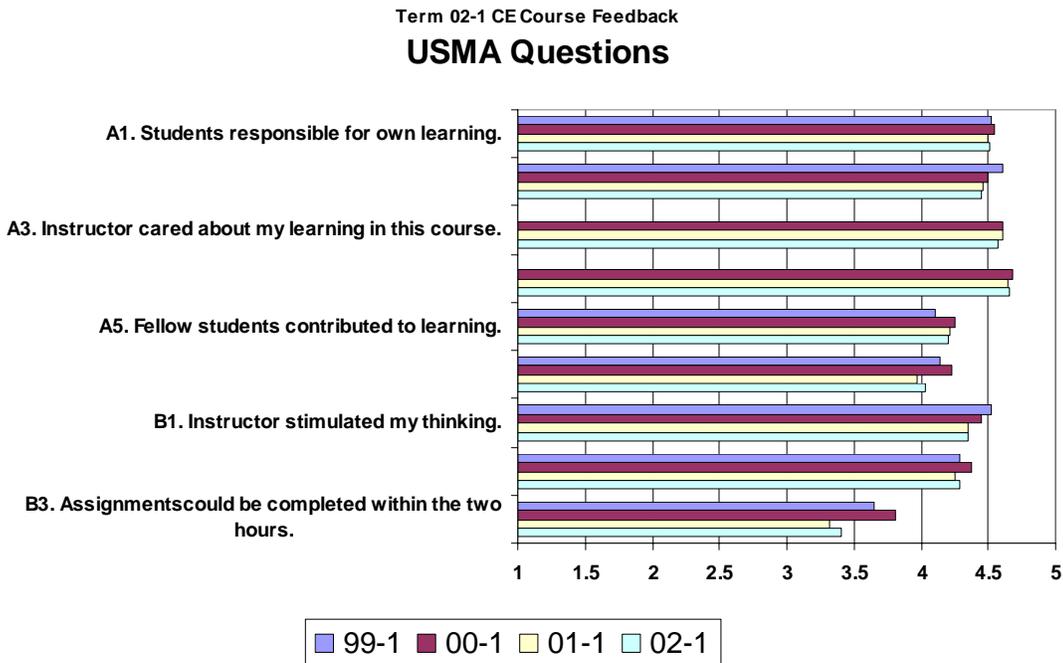


Figure 3: Instructor Ratings Over Time in Critical Areas

Table of Course Objectives	Cadet Assess.			CD
	00-2	01-2	02-2	Score
Describe the characteristics of a profession.	4.33	4.21	4.52	4
Describe the roles and responsibilities of the principal members of the Project Team.	4.24	4.11	4.10	5
Analyze how the quality of a constructed facility is affected by the interactions between the members of the Project Team.	4.29	4.33	4.59	5
Explain the advantages and disadvantages of bidding vs. quality-based selection processes for acquiring engineering and construction services.	---	4.57	4.21	3
Apply the ASCE Code of Ethics to the solution of an ethical problem confronting a practicing engineer.	4.27	4.52	4.47	4
Demonstrate an appreciation of the multi-faceted challenges facing CEs in professional practice.	4.22	4.28	4.12	4
Describe the professional registration process.	4.07	3.96	4.11	3.5

Figure 4: Results From CE 400A That Compare the Assessments of Student Performance from the Course Director to the Assessments of the Students Over Time

students feel that they have a much greater understanding of the difference between bidding and quality based selection than the instructor believes they have. The most recent students (02-2) feel they have a greater understanding of the characteristics of a profession and a lesser understanding of the challenges facing civil engineers in practice than students in previous years, but the difference is not large in either case. Large changes over time and significant discrepancies between what the students and instructors believe are areas that merit attention.

Student grades over time can also be an indicator of student performance. Fig. 5 shows student quality point averages for a given course over time. Eventually, we realized that the final course average by itself is not always a good measure, so the incoming quality point average of the students in the course was added three years ago to make the data more relevant. There are many variables that can affect grades. This tool is probably only valuable if there is a large change from previous performance in a given year. In the USMA Civil Engineering department, term-end examinations are never returned to the student and are carefully safeguarded. As a result, only minor changes are made from year to year on the final exam, which provides a more consistent measure of student performance from year to year. Fig. 6 shows the student averages on a similar final exam over time.

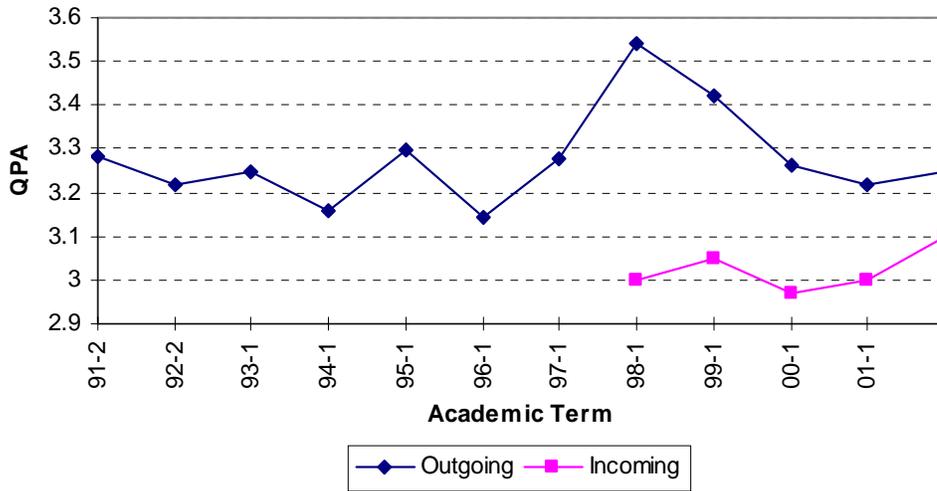


Figure 5: Grade Point Average Performance in a Course over Time Compared to the Incoming Grade Point Average of the Enrolled Students

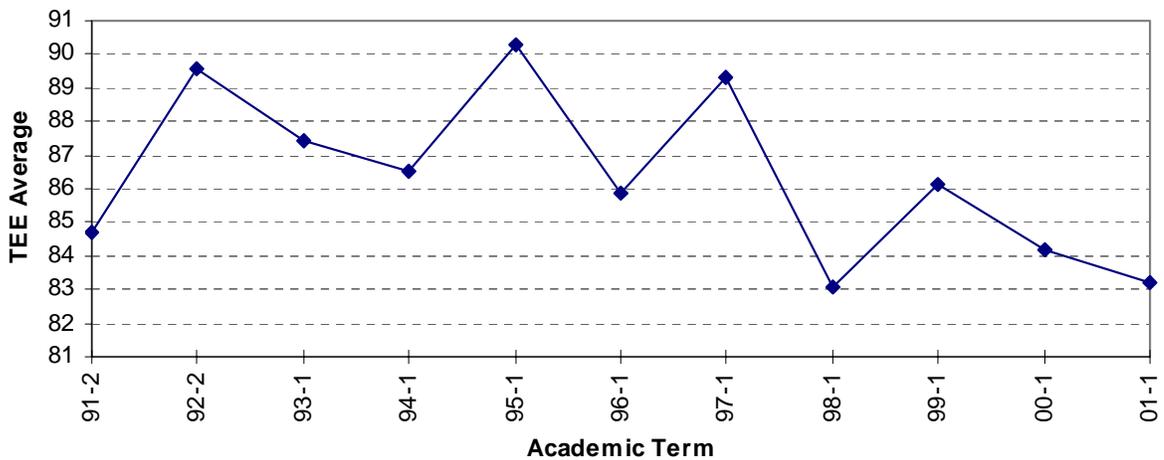


Figure 6: Course Performance on the Term End Examination Over Time

Another assessment measure of student learning is the amount of high quality time the students are spending on course activities outside the classroom. This also provides an assessment as to whether one is overworking or under working the students. The data is obtained anonymously by passing a survey sheet around the class every lesson. The student records the amount of time in minutes that he or she has spent working on this course since the previous course meeting. Fig. 7 shows the average time spent for each

lesson and the cumulative time over a 40-lesson semester for an individual course. The cumulative time came to approximately 70 minutes per student per lesson over the semester. Fig. 8 shows the average time spent by students in a course over time. An appreciable rise or drop in time is cause to examine what may have been done differently in a course and unreasonably large spikes of time (Fig. 7) might indicate that a particular assignment was too demanding.

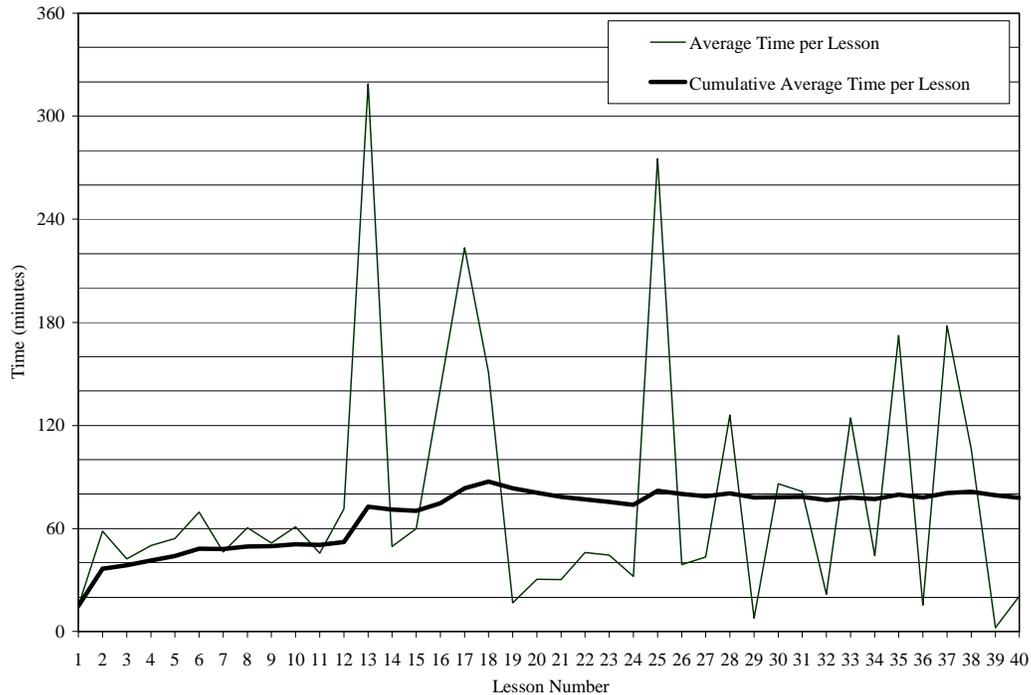


Figure 7: Time Survey Date for a Course Over a 40 Lesson Semester. Time Per Lesson and Cumulative Average are Recorded

### Personal Observation

Another means of teaching assessment is the personal observation of a faculty member by another. West Point has a large annual turnover of instructors as many of the military faculty teach for three years and return to the field Army. As such, a rigorous six-week teacher training program is conducted each year where new instructors observe demonstration classes from veteran faculty members, attend seminars on how to teach, and then teach seven sample classes to an audience of their peers and senior faculty members. The instructor is videotaped and receives a detailed assessment after each class. A standardized teaching assessment worksheet is used to cue the observer. The worksheet provides space to write the strengths and areas of improvement as they occur throughout the class. The observer specifically gives a rating of “needs work”, “good”, or “excellent” in specific areas relating to technical expertise, lesson organization, conduct of the class, and the class room environment. These areas as shown in Fig. 9

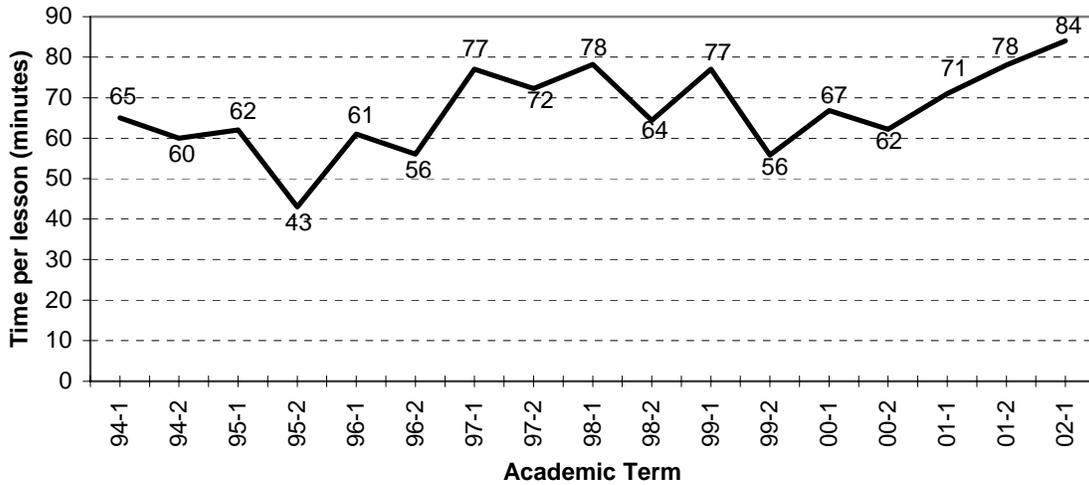


Figure 8: Student Time Per Lesson for a Course Over Time

	Needs Work	Good	Excellent	Remarks
<b>TECHNICAL EXPERTISE</b>				
Command of the Subject Matter		✓		
<b>LESSON ORGANIZATION</b>				
Lesson Objectives			✓	
Organization of Boards & Classroom Activities			✓	Nice flow!
<b>CONDUCT OF THE CLASS</b>				
Enthusiasm, Energy, and Confidence			✓	
Orientation to the Subject Matter			✓	
Clarity of Presentation (boards, viewgraphs, etc.)		✓		
Clarity & Precision of Explanations		✓		16, 19
Voice (volume, speed, variation)			✓	
Questioning & Answering Questions		✓		6, 21
Contact with Students			✓	very engaging.
Visual Aids and Demonstrations			✓	8, 10, 22
Time Management		✓		10
Appropriate Use of Textbook			✓	2
<b>THE CLASSROOM ENVIRONMENT</b>				
Classroom Appearance				
<b>OVERALL ASSESSMENT:</b>				
Are the students who attended this class adequately prepared to accomplish the Lesson Objectives? <input type="checkbox"/> No <input type="checkbox"/> Not sure <input checked="" type="checkbox"/> Yes				

Specific areas on which to focus during your next class:

1. Work on precision in use of terminology.
2. Use more directed questions; fewer "jump balls"
3. Find an alternative to "guys" in referring to students.

Figure 9: A Portion of the Teaching Assessment Worksheet Used by Class Observers to Assess an Individual Class

related directly back to the ExCEED model. As a final conclusion, the observer assesses whether the students could complete the lesson objectives based on the class given and suggests the top three areas on which to focus for the next class. In the later classes, the new instructors are required to do a self-assessment to enable them to improve on their own throughout the semester.

As the school year progresses, the personal observation continues. The Division Director will visit each instructor at least once per year and the Group Director will visit at least once per semester. A teaching assessment worksheet is completed and given to the instructor after the observed class and together they discuss the elements of the class.

### Teaching Assessment at the Program Level

A department head or program director may wish to assess the quality of teaching in his or her area of responsibility. The same student survey tools can be used to compare the ratings of various courses in the program as shown in Fig. 10. This helps indicate where more attention is needed. Of course, there may be a disparity between upper division design courses and lower level engineering science courses due to the relevance of the material, the size of the class, and the relationship between instructor and student. Data over time may better indicate if there is a problem with a particular course.

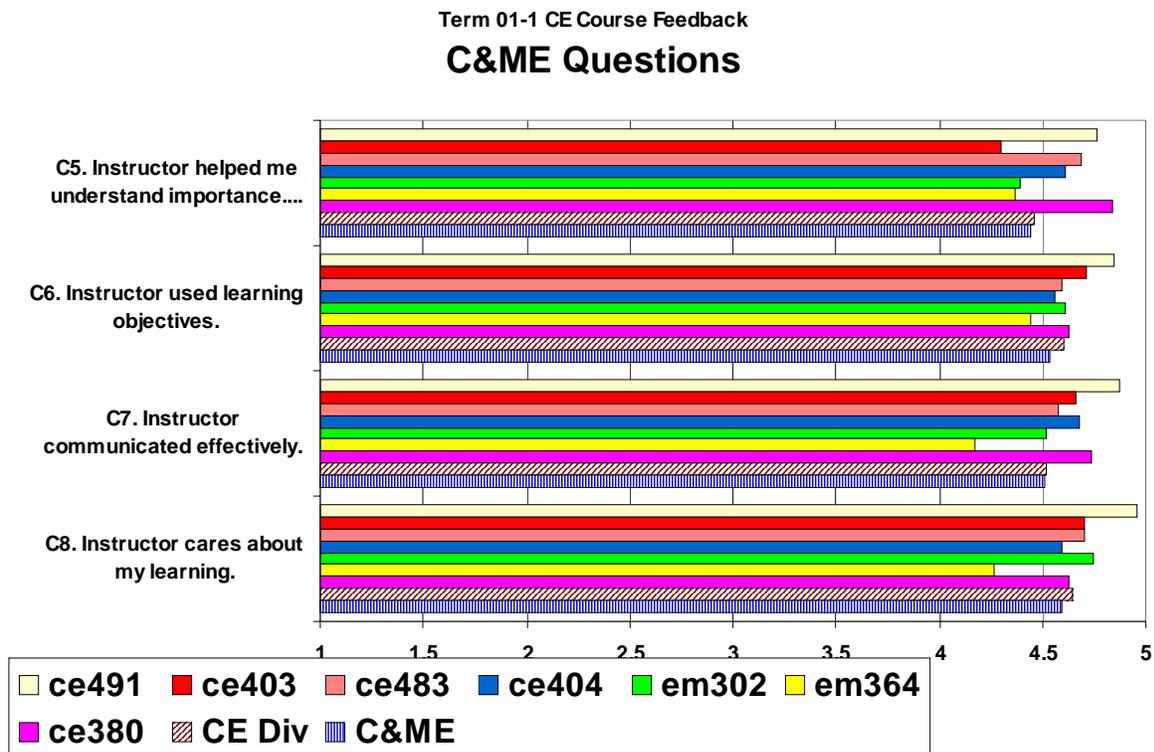


Figure 10: Student Ratings on Instructors Over Various Courses in the Civil Engineering Program

A department leader can observe classes personally. It takes a lot of time, but if spaced over the period of an entire semester or academic year, it is doable to visit everybody at least once. A very positive way to assess teaching is to implement a teaching awards program where the best teachers are visibly and prominently honored. A financial reward or genuine credit towards tenure would get everyone's interest. The West Point civil and mechanical engineering programs have implemented an annual teaching award for instructors with less than two years teaching experience and another for veteran instructors. Peers and department leadership make the nominations. The winner is decided based on student ratings, classroom visits, and teaching portfolios.

## Conclusion

Classroom teaching is a critically important factor in student learning and motivation. Teaching is an art and everyone does it somewhat differently. Good teachers must use their own personality traits and natural abilities to their best advantage. Some would contend that standardized assessment is therefore impossible. This article has attempted to demonstrate otherwise. Even though personalities and specific techniques will vary considerably, there are certain components that are universal to good teaching. They include knowledge, enthusiasm, rapport, and organization. The ExCEEEd model is just one attempt to capture those. Once identified, these areas can be assessed using a number of indicators. An amalgam of student opinion, student performance, personal observation, student time on task, and instructor ratings can be used in combination to form an assessment. When this data is compared over time and against other courses and instructors, it becomes a valuable and valid tool for assessing teaching by an individual and within an entire program.

When Seymour and Hewitt<sup>1</sup> asked how the situation of poor teaching in the math, science and engineering disciplines could be improved, the student consensus was teacher training, senior faculty mentoring, and a system where good teaching was recognized and rewarded. This article is in agreement with those students.

## Bibliography

1. Seymour, Elaine and Nancy M. Hewitt. *Talking About Leaving: Why Undergraduates Leave the Sciences*. Boulder, Colorado: Westview Press, 1997.
2. ExCEEEd Teaching Workshop, American Society of Civil Engineers, [http://www.asce.org/exceed/etw01\\_slides.cfm](http://www.asce.org/exceed/etw01_slides.cfm), West Point, NY 2001.
3. Lowman, Joseph. *Mastering the Techniques of Teaching*. San Francisco: Jossey-Bass, 1995.
4. Wankat, Phillip C. and Frank S. Oreovicz. *Teaching Engineering*. New York: McGraw-Hill, 1993.

## ALLEN C. ESTES

Colonel Allen C. Estes is an Associate Professor and Civil Engineering Division Director at the United States Military Academy (USMA). He is a registered Professional Engineer in Virginia. COL Estes received a B.S. degree from USMA in 1978, M.S. degrees in Structural Engineering and in Construction Management from Stanford University in 1987 and a Ph.D. degree in Civil Engineering from the University of Colorado at Boulder in 1997.

**STEVEN J. RESSLER**

Colonel Steven J. Ressler is a Professor and Deputy Department Head for the Department of Civil and Mechanical Engineering at the United States Military Academy at West Point, NY. He is a registered Professional Engineer in Virginia. COL Ressler graduated from USMA with a B.S. degree in 1979. He obtained his M.S. degree and Ph.D. degrees from Lehigh University in 1989 and 1991, respectively.