

## Classroom Quality Assurance Using Students as Quality Managers

Dr. Deepti Suri

Assistant Professor  
Department of Electrical Engineering and Computer Science  
Milwaukee School of Engineering  
Milwaukee, WI 53202  
suri@msoe.edu

**Abstract:** *End-of-term classroom evaluations frequently serve as the primary means for eliciting student feedback regarding teaching effectiveness of the instructor. Since the input from this assessment tool is collected so late in a term, the instructor is unable to make adjustments to enhance the learning experience of the current group of students. For effective teaching, it is important that student input be solicited at regular intervals throughout the term. Over the years, several classroom assessment techniques like “The Minute Paper”, “Muddiest Point”, “Chain Notes”, etc. have been proposed to address this issue. This paper explores a new collaborative partnership between the instructor and the students based on using student representatives as Quality Managers (QMs) for the course. The advantages, disadvantages and positive impact of involving students as major stakeholders in the assessment process along with results from several courses in an undergraduate Software Engineering Curriculum are presented to demonstrate the impact of the approach on classroom instruction as well as on student learning.*

### 1. Introduction

The methods typically employed by an instructor to solicit feedback on a regular basis regarding their own effectiveness or the students’ learning in a classroom setting include (i) Asking students if they have any questions (ii) Instructor’s reaction to student’s questions (iii) Monitoring the students’ body language and facial expressions and (iv) Reading home-works, tests, lab assignments and so on. Even though these techniques are a large part of an instructor’s daily lives, collecting feedback in this way is a subconscious and implicit process. The candidness and quality of the feedback is also suspect because instructors almost always come across some students in the classrooms, who are very insightful but will not talk or voice their opinions in a public forum.

The primary “formal” evaluation technique used to elicit student feedback regarding the teaching effectiveness of the instructor is the end-of-term classroom evaluation. The feedback obtained from the students is usually candid in this case, but is collected so late in the term that the instructor is unable to make adjustments to enhance the learning for the current group of students.

The general consensus among the teaching community is that student evaluation should be solicited at regular intervals. Student evaluations solicited a couple of times during the term

combined with the mandatory evaluations collected at the end of the term provide a good feedback mechanism to improve teaching and learning in the classroom. Timely feedback allows instructors to make adjustments to ensure that students are learning the material. One of the additional benefits of classroom assessment is the appreciation shown by the students. Students are generally appreciative of the interest shown by the instructor in improving teaching and facilitating their learning.

## **2. Popular assessment techniques**

Over the years, several classroom assessment techniques have been proposed to enhance student learning [1]. Some of the more traditional and popular ones have been enumerated and explained for the benefit of the reader.

While using the “The Minute paper” assessment technique, an instructor stops the class 2-3 minutes early and asks students to respond briefly to some variation of the question, “What was the most important thing you learned during this class?” This technique provides manageable amounts of feedback on how well the students are learning the subject that is being taught in the class. This feedback can help the instructor make timely adjustments and changes in the classroom. Since the student has to quickly and briefly respond to the question, it helps them to learn on how to separate out the major points from details.

In the “Muddiest point” technique, the student is asked to jot down a quick response to the question, “What was the muddiest point in topic \_\_\_\_\_?” Using this technique the instructor can quickly and easily discover which points are most difficult for students to learn, what topics to emphasize, etc.

“Chain notes” is another popular assessment technique used in the classroom. During lecture the students pass around a large envelope on which the instructor has written one question about the class. When the envelope reaches a student, he/she spends less than one minute to respond to the question, then drops the card in the envelope and passes it on. This technique elicits a limited amount of feedback about teaching/learning occurring at a given moment during the class and helps the instructor as well as the student facilitate a better learning environment.

With the increasing popularity of non-traditional approaches like problem-based learning, collaborative learning and other approaches to revising engineering education, several new techniques for assessment are being developed [3] [4]. At some universities, including Columbia, the evaluation data by course or professor can be viewed online and are used by students to guide them in course selection [3]. By making the ratings public, the school has experienced an increased awareness of teaching and course quality for both students and faculty.

## **3. Classroom Quality Assurance (CQA)**

The academic schedule at Milwaukee School of Engineering (MSOE), the author’s university, is based on a quarter system with three quarters (Fall, Winter and Spring) in an academic year. Each quarter consists of ten weeks of instruction with the eleventh week devoted to final exams.

Based on the interesting concept suggested in [2] of letting students solicit feedback from the class, the author started a collaborative partnership with the students, starting Spring Quarter

2001, where various student representatives serve as “Quality Managers” (QMs) for the course. Typically, on first day of the class, volunteers from the class are solicited who agree to become the Quality Managers for the course. They serve as a liaison between the students and the instructor for the rest of the term. The goal is to have at least three “Process Assessment and Improvement Surveys” during the term, typically in Weeks 3, 5 and 8, with one QM from the class being responsible for one of them. The end-of-term final evaluations are collected at the end of Week 10.

Every 2-3 weeks, a list of questions is sent to the QM by the instructor, which he/she believes should be included in the feedback process. (Research suggests [1] that the type of assessment most likely to improve teaching and learning is that which is conducted by faculty to answer questions they themselves have formulated in response to issues or problems in their own teaching.) The QM has complete authority to add/delete and edit those questions. The survey instrument that is prepared by the QM and handed out to the class typically contains questions

**Figure1: Sample questionnaire generated by the instructor**

Process Assessment and Improvement Survey #1

Date: \_\_\_\_\_

Based on your experience in this class

- 1) Please comment on the clarity and your understanding of the material presented.
- 2) Please comment on the usefulness of the lab assignments.
- 3) What could have been differently, better (please be specific)?
- 4) What was done well (please be specific)?

from the instructor as well as those deemed important by the QM. The completed surveys are returned to the QM, who then compiles the results and makes concrete recommendations to the instructor on various changes that could be implemented in the classroom. These results and recommendations are also distributed to the entire class. The author has always volunteered to compile the

results if the QM does not have time to do so, but almost always the QM “wants” to do it himself/herself.

For example, Figure 1 indicates the set of questions that were sent to the QM by the author in the

**Figure2: Questionnaire generated by the Quality Manager**

Process Assessment and Improvement Survey #1

Date: \_\_\_\_\_

Based on your experience in this class

1. Please comment on the clarity and understanding of the material presented.
2. Please comment on the usefulness of the lab assignments.
3. What could have been differently, better (please be specific)?
4. What was done well (please be specific)?
5. Have you used the book?
6. Please rate the amount of work so far on a scale from 1 to 5.  
 1 = Less than other classes this quarter  
 3 = About the same as other classes this quarter  
 5 = More than other classes this quarter

course “Software Verification and Validation” (SE-483) for the “Process Assessment and Improvement Survey #1” in the Fall Quarter of 2001. The questionnaire that was presented to the students by the QM after editing is displayed in Figure 2. Apparently, the QM believed that there were issues regarding the textbook that was assigned for the course and the course workload and hence decided to include them in the

questionnaire. The author believes that she would not have known that these were important issues for the students but for the collaboration with the QM.

The compiled feedback results along with the set of recommendations provided by the QM are displayed in Figures 5-6 at the end of the paper.

The advantages of this approach and the reasons why the author believes this approach has been successful in her classroom are:

- Having the Quality Managers accountable for the completing the process ensures that feedback is collected from the students on a regular basis and makes the instructors more accountable to the feedback that they receive. It demonstrates their commitment to improving their teaching.
- By involving students as major stakeholders in this process, the class becomes an ally in this process. The class feels empowered with the realization that creating a positive learning atmosphere in the class is not only the instructor's responsibility but theirs too.
- The feedback that is collected is more candid. Even though the questionnaires have always been anonymous, the fact that the instructor does not see the originals (they are submitted to the QM by the students) ensures that the students can be candid and honest without any fear of retribution.
- Since the QM makes a set of recommendations to improve the class and sees the instructor act on them, an atmosphere of trust and friendship is built between the students and the instructor.
- The class does not see the same questions repeatedly. If a standard form is used in the class on a regular basis, it tends to become boring for the class. The author acknowledges that a standard form makes it easier to track improvement and deterioration in particular areas though. A side effect of having the QMs add, delete and edit questions on the feedback form is that a reasonable variety of questions are being asked to the class as part of the feedback process.

Like all assessment processes, this process has several disadvantages too. To name a few:

- There is usually a high turnaround time. From the time the initial set of questions is mailed to the QM to the time the compiled results are received; it can be a week or even more depending on the schedule and commitment of the QM. In a term of 10 weeks, this can be a significant amount.
- It requires some planning and time commitment on part of the instructor and the QM.
- There are no special rewards for the QM for their effort and commitment. This might be a roadblock for students who might be interested but are swamped with other commitments.
- The quality of the recommendations is only as good as the commitment of the QM.

#### **4. Results**

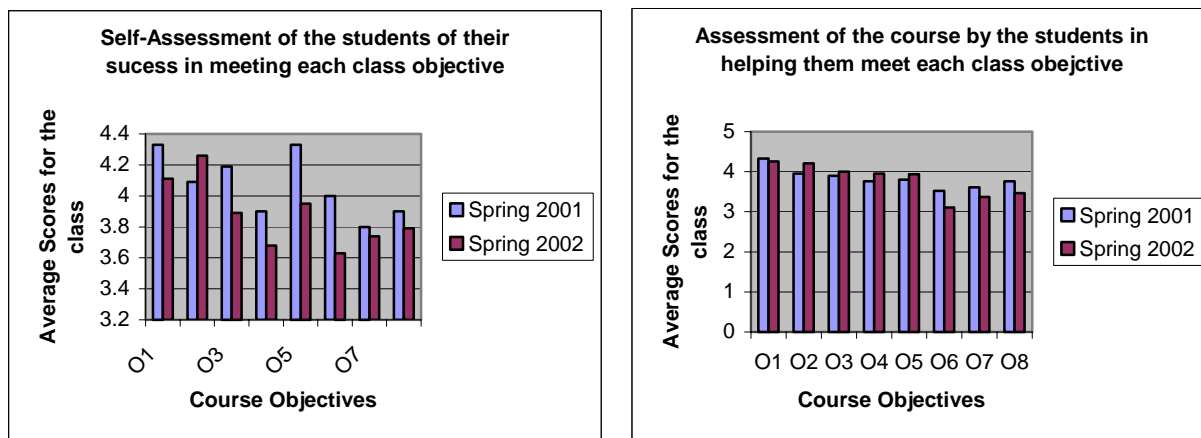
At MSOE, each course has a set of objectives that are published and distributed to the students at the beginning of the term. At the end of the term, students are asked to evaluate themselves on how successful they were at meeting each objective and then evaluate the course on helping them meet those objectives. The rating used is 1 (not successful at all) to 5 (very successful).

The course objectives for a software engineering course, Software Component Design (SE-281), which is typically taken by sophomores is presented in Table 1. The average scores of all the students for all the eight objectives for SE-281 offered in Spring 2001 (when the proposed approach was used first) and Spring 2002 (when the approach was used again) are compared and the results presented in Figure 3.

Though the student pool was different and hence it is difficult to make any conclusive judgments, it should be mentioned that the course had not changed much between the two offerings. The class size was similar also. In Spring 2001, the class had 21 students versus 19 in Spring 2002. The results show that the students in the class in Spring 2002 believed that they did not achieve each class objective as well as the students in class in Spring 2001 had. This is also reflected in the distribution of final grades. For Spring 2002 the grade distribution was A-4, AB-1, B-1, BC-4, C-3, CD-1, F-5 whereas for Spring 2001 it was A-5, AB-4, B-2, BC-4, C-1, CD-3, D-1, F-1. Surprisingly enough, the students in the class in Spring 2002 also did not seem to blame the class for it. In fact, there was a slight overall improvement in the scores they had given to the course for helping them achieve these objectives.

**Table 1: Course Objectives for SE-281**

O1	Understand and apply object-oriented design patterns
O2	Understand the use of UML in the design process
O3	Be able to design and implement small software components and systems
O4	Be able to use computer-aided software engineering (CASE) tools in the design process
O5	Be able to work effectively as a member of a small team
O6	Be able to do independent research on software design
O7	Be able to document software design concepts in a written report
O8	Be able to communicate software design concepts in a brief oral presentation



**Figure 3: Comparison of the two offerings of SE-281 in Spring 2001 and 2002.**

A subset of some of the more interesting comments and recommendations received by the author from various Quality Managers for different courses are presented here for the benefit of the readers.

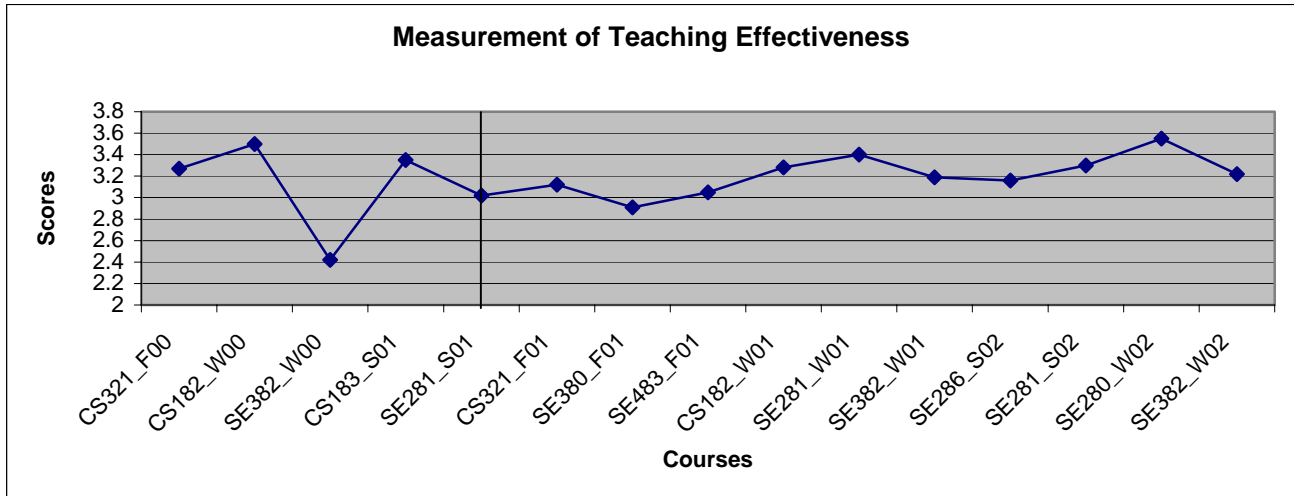
- I think a majority of the students are frustrated with Rational Rose. The “Introduction to Rational Rose” lecture should have been done hands-on with each person on their laptop. *[Note: This comment was received in SE-281 in Spring 2001 and used in Spring 2002]*
- Present material with the consideration that most students have never worked on a large software product or in a business team setting.
- More interaction in the class. Focus each lecture on the student, instead of just the book material. Try to think “If I was a student, how would I use this information to make me a better SE?”
- Dr. Suri makes a very serious effort to improve her teaching style.
- The class discussions have been getting better.
- The slides when not on a certain point, fade to a color which is hard to read.
- Overall, the students seem quite satisfied with the way that the class is proceeding. Many students, including myself, like the new slides. In my opinion, compared to the slides given for Software Architecture, these slides have more content on them, and will make much better study aids when it is close to exam time.
- Also, several students liked the book. The book seems to be understandable and readable. One student also mentioned that the material presented in class is well coordinated with where we should be in the book. This is a good thing, because the reading reinforces the lecture, or vice versa.

As can be seen, some of the suggestions to improve teaching and facilitate learning are very practical, have low overhead and are easy to implement. Therefore, they can easily be incorporated in a classroom setting. Educational psychologists [5] [6] have long been of the opinion that if the students have some control of their learning; they suggest approaches in the classroom that are beneficial to them. The author has witnessed this in her classrooms. Another interesting observation is that some comments have nothing to do with teaching/learning. It appears that both the physical and social aspects of a learning environment influence student participation and satisfaction.

On a more personal note, the author notes that her teaching evaluations have generally seen an improvement. The standard form used for end-of-term classroom evaluations asks each student to evaluate the “Quality of Teaching” amongst many other things as a measure of the teaching effectiveness of the instructor. The student is requested to fill out a letter grade between A (4) to F (0). The results of this question from the author’s evaluations have been tabulated and presented in Figure 4. The x-axis indicates the course number and the quarter (Fall, Winter, Spring) in which it was taught and the y-axis indicates the numerical score. The vertical bar indicates the term and the course where the proposed approach was used for the first time.

## 5. Conclusions

This paper summarizes the author’s experience with an assessment technique that uses student representatives as Quality Managers for a course. The advantages and disadvantages of the proposed approach are also presented along with specific examples on how student feedback has influenced the instructor’s teaching style and effectiveness.



**Figure 4: Teaching Effectiveness Scores**

## 6. References

- [1] "Classroom Assessment Techniques: A Handbook for College Teachers" Thomas A. Angelo and K. Patricia Cross. Second Edition. 1993. Jossey-Bass.
- [2] "Advice for New Faculty Members: Nihil Nimus" by Robert Boice, Allyn and Bacon, 1999.
- [3] "Student Assessment of Faculty Performance: An Alternate Approach", John C. Wise, Dhushy Sathianathan, Thomas Colledge, 32<sup>nd</sup> ASEE/IEEE Frontiers in Education Conference, T3B-1, 2002.
- [4] "Web-Based Course Evaluation: Comparing The Experience At Two Universities", Jack McGourty, Kevin Scoles, Stephen Thorpe, 32<sup>nd</sup> ASEE/IEEE Frontiers in Education Conference, T3B-1, 2002.
- [5] "Defensive Climate in the Computer Science Classroom", Lecia Jane Barker, Kathy Garvin-Doxas, Michele Jackson, 33<sup>rd</sup> SIGCSE Technical Symposium on Computer Science Education, pp. 43-47, 2002.
- [6] "Learning Styles and Performance in the Introductory Programming Sequence", Lynda Thomas, Mark Ratcliffe, John Woodbury, Emma Jarman, 33<sup>rd</sup> SIGCSE Technical Symposium on Computer Science Education, pp. 33-37, 2002.

## DEEPTI SURI

Deepti Suri is Assistant Professor of Software Engineering in the Department of Electrical Engineering and Computer Science at the Milwaukee School of Engineering (MSOE). She primarily teaches Software Engineering courses in the areas of Software Requirements and Specifications, Object Oriented Design, Design Patterns and Verification and Validation.

Prior to joining MSOE, Dr. Suri worked in industry for seven years. She has provided systems solutions for the Electronic Design Automation (EDA), financial, and health-care industries. Her experience includes working in all aspects of the project's life cycle.

Ms. Suri holds three degrees B.S. (1989), M.S. (1991), and Ph.D. (1999) in Computer Science. She has written several articles in the areas of Robotics, GUI design and parallel computing and presented her work at national as well as international conferences.

### September 20, 2001 SE-483 Survey Responses

- All text is entered exactly as the student wrote it (except by my entry mistake or a spell check correction)
- Answers to each question were sorted alphabetically – Thus, there is no correspondence between the same entries in different questions.

#### 1) Please comment on the clarity and understanding of the material presented.

- Dr. Suri obviously understands the material, but I have trouble seeing the information as an integrated flow and not just stories.
- I have some work prior experience with testing and these concepts so I am able to fill in some gaps in the lecture information
- I think my understanding of the material is pretty good.
- It's a review of other courses.
- Material is presented clearly
- Most of what has been done is overview and review. The little material that has been presented is good.
- Mostly Review
- Nice
- So far I feel that everything has been clear and haven't had problems understanding anything (who knows though, this may change when tested on the material)
- So far the clarity that has been covered has been mediocre. At time she covers the material really well. At other times she drops the slides on at is consistently talk about the same stuff, especially when it is stuff we already know.
- So far the material has seemed pretty straight forward and to the point.
- Some of the pieces are presented well, but I don't have a strong feeling of coherence between different subjects. A course outline (other than the tentative schedule) would help bring things together.
- The understanding of the material was pretty easy. Sometimes, however you do not clearly present the material. You get scatterbrained.
- V&V has a high amount of overlap making it unclear from the start. More specific examples will greatly improve clarity.

**Recommendation: Include specific examples of the material you are presenting.**

#### 2) Please comment on the usefulness of the lab assignments.

- I see the early lab assignments as preliminary work and not as useful; but I do think they are necessary.
- I think they will give us better practice w/ ReqPro
- It's nice having a class period for lab.
- Labs up to now are nothing new, just pre-preparation. Later labs will be better, but I don't see how using the old SDL projects are better than another option.
- Mostly useless in dealing with V&V. Labs have been strictly for Reqs and Specs.
- Overall, I think they so far the labs have been completely useless. We already knew how to do an SRS, and it isn't that hard to do a traceability matrix.
- So far, not extremely useful. Although, doing the traceability matrix was useful.
- So far, the lab assignments haven't been that useful (as far as the class objectives are concerned), but I believe that is because so far all we have done is introductory stuff so that we can actually use our projects for Verification and Validation.
- The first lab was necessary but seemed light. The second lab was a review of Requirements & Specifications.
- The lab assignments have only been useful in relation to their continued learning of requirements. Usefulness for this lab = 0.
- The lab is good to backup what is said in class. Though I believe there should be scheduled lab periods to get the work done.
- They seem to be leading into usefulness.
- They are getting more useful over time.
- They don't seem applicable yet, but I anticipate this will change.

**Recommendation: None. I agree that the first two labs were really Reqs & Specs oriented, but I do not believe that there was not any other way to ensure completeness of a ReqPro project before we get into the "real" V & V stuff. IMHO, using the previous SDL projects was the only possible choice; the students know them well, and (most of the projects) have been implemented and tested already.**

**Figure 5: Compiled Feedback results and recommendations submitted by QM for SE-483 in Fall 2001.**



**3) What could have been done differently, better (be specific)?**

- Better organized flow of information, Notes handed out every day.
- Coordinating two teams each at five people is extraordinarily difficult.
- Handouts for each class period.
- I don't like having to schedule another 5 person team meeting but I don't see an alternative.
- I think that one problem is concentrating heavily on PowerPoint which no examples. If you are going to only use PowerPoint have a lot of examples.
- I would stop and ask the students questions more often. It requires them to be paying attention. Again, I would either make the handouts available 24 hours before class or hand them out during class.
- May be using projects other than old SDL projects for the lab, although I don't know which ones.
- Perhaps have projects already at the point we are now at so that students don't spend so much time doing stuff that is not pertinent to the class. It would also have been nice to have a scheduled lab time since it is hard to find a time that everyone can meet
- Smaller groups with an already spec'd & built system that all students could verify & validate.
- Try new methods of getting people to pay attention. Your lectures tend to be boring.
- Unknown

**Recommendation: Supply handouts. Involve the students to help them pay attention. Again, use examples.**

**4) What was done well (be specific)?**

- Answering any questions during the lecture and being prepared (although it would be really nice if the handouts were already printed out since everyone will eventually do that anyway).
- Changing the room to a warm CC room :)
- Discussion of what V & V means. Handouts of notes :)
- I think the conference that you attended has already been quite useful to the class.
- PowerPoint presentations are a valuable resource
- Reserving one of the class periods for group work is a good move.
- The example handouts (classics example and the other one) were large helps.
- The only think that was done well was bringing in that information from her conference, however she did not cover it very well so it was hard to understand.
- The structure was well laid out considering this is a first run.
- You have pictures in your presentations. (The V-model). Pictures are concise. They quickly describe something well.

**Recommendation: None.**

**5) Have you used the book?**

- No (8 responses)
- No, not yet. (But I did buy it)
- No. Because you made the book seem useless, I did not
- Nope. There's a book? How much is it?
- Not Yet.
- Very minimally.
- What book?

**Recommendation: If a book isn't going to be \*required\* for a course, don't make a student buy one. It is possible to hold a course (and get a lot from it) without a required book.**

**6) Please rate the amount of work so far on a scale from 1 to 5.**

**1 = Less than other classes this quarter  
3 = About the same as other classes this quarter  
5 = More than other classes this quarter**

- 1 (2 responses)
- 2 (3 responses)
- 3 (7 responses)
- 3 About the same as other classes (some but not too much)
- 3 for now, later it will likely ride to 5

**(Average 2.5)**

**Recommendation: None.**

**Figure 6: Compiled Feedback results and recommendations submitted by QM for SE-483 in Fall 2001 (contd.).**