# *Random Thoughts . . .*

# HARD ASSESSMENT OF SOFT SKILLS

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So, you've been told that as part of your department's plan for addressing the ABET (or Bologna or Washington Accord) accreditation criteria, you've got to teach your students how to communicate effectively and/or discuss engineering solutions to social problems and/or analyze and resolve ethical dilemmas. You just have two small problems to solve. First, how do you teach those skills when (if you're like most of us) no one ever taught them to you? Second, how do you assess how well your students have mastered the skills?

Let's look at the assessment question first. In most engineering and science courses, the things we grade are mainly solutions to quantitative problems, short answers to closed-ended questions, and multiple-choice test items. You can grade those things objectively without much difficulty as long as the questions are clear, the correct answers are not a matter of opinion, and the grader awards points consistently. It's a different story when it comes to grading essays and written and oral project reports. Since there are no unique "correct answers," subjective and inconsistent judgment calls often contaminate the grading. When that happens, student resentment and complaints can quickly get out of hand, and many students never learn the skills you are trying to teach because they don't really understand the criteria they are being graded by.

The challenge in evaluating "soft" student products is to find a grading process that is *reliable* (a given product would get almost identical marks from two or more expert graders and from the same grader at different times), and *fair* (the students know the grading criteria—what counts, and by how much; the grading is based entirely on the criteria; and the students have been adequately instructed in the methods and skills required to meet the criteria). Two types of instruments—checklists and rubrics—can provide both reliability and fairness.

A *grading checklist* is a form that lists the instructor's grading criteria and the maximum points allocated to each criterion. The instructor assigns up to the maximum points for each criterion and totals the points to determine the final assignment grade. Table 1 shows an illustrative checklist for written reports.[1] A *grading rubric* also lists the grading criteria, but now the instructor scores each one on a discrete scale (*e.g.*, 5-4-3-2-1 or 4-3-2-1) and gives brief descriptions of what each numerical rating represents. The overall product grade is determined as a weighted sum of the points given for each criterion, with each weight representing the relative importance of that criterion to the instructor. Table 2 shows an illustrative excerpt from a rubric used for rating individual team member performance in group projects.[2] Another good example is a rubric designed to evaluate both individual and team performance on an oral project report in an engineering design course.[3] Creating rubrics is made easy by a free online tool called *Rubistar®* (*<http://rubistar.4teachers.org>*).

Once you have a checklist or rubric, grading student work becomes much more efficient than the usual procedure in which detailed feedback is provided on each student product, and more reliable because the breakdown of points by criteria makes it more likely that products of the same quality will get the same grade. The students can quickly see why they got the grades they did and where their work fell short of your expectations, and they should emerge with a clear idea of what they need to do to raise their grades on subsequent assignments. The system is even more effective if you use two raters (*e.g.*, you and a trained teaching assistant, or two teaching assistants) to grade all student products. If the raters fill out their forms independently and then reconcile their ratings, the grading will be at least as objective and reliable as what we normally do for quantitative problem-solving tests.

Checklists and rubrics are also excellent tools for teaching students the procedures and skills required to meet the instructor's expectations. For example, suppose you plan to give several writing assignments in your class. Before the students begin work on the first one, give them two sample completed assignments—one that makes most of the mistakes you anticipate your students will make in their initial efforts (inadequate background discussion, unsupported conclusions, bad grammar, sloppy graphics, etc.), and one much better. In or out of class, have them individually use your checklist or rubric to grade the first sample assignment, and then in class have them work in pairs to reconcile their ratings. If they can't agree on a rating, have them average their individual scores. Poll them to get their reconciled ratings for each criterion, and then tell them the ratings you would have given and why. Repeat the exercise with the second assignment. At that point the students will have a clear idea of what you are looking for, and their products will on average be far better than those you are used to seeing.

Similarly, before your students give oral reports, give a short illustrative talk yourself and deliberately make the common

mistakes you know many of them will make (read directly from a manuscript, lecture to the board and mumble, rapidly show lots of PowerPoint slides with garish backgrounds and cluttered text, and so on). The students will quickly see what you're doing and start laughing and maybe throwing things at you. Stop after a couple of minutes and have them individually rate your talk using your checklist or rubric and then reconcile their ratings in pairs. After you discuss the ratings and give yours, give a better talk that still has mistakes, and repeat the exercise. Prepare to be pleasantly surprised at the quality of the oral reports most of them subsequently give.[4]

## REFERENCES

1. Checklist designed by Professor Lisa Bullard, North Carolina State University, and reproduced with permission.
2. CATME (*Comprehensive Assessment of Team Member Effectiveness*) Web site, <*www.catme.org*>
3. Welch, H., D. Suri, and E. Durant, "Rubrics for Assessing Oral Communication in the Capstone Design Experience: Development, Application, Analysis, and Refinement," *Intl. J. Engr. Ed.*, **25**(5), 952 (2009)
4. For additional tips on teaching and assessment strategies that address each of ABET Outcomes 3a–3k, see Felder, R.M., and R. Brent, "Designing and Teaching Courses to Satisfy the ABET Engineering Criteria," *J. Engr. Education*, **92**(1), 7 (2003) <*http://www.ncsu.edu/felder-public/Papers/ABET_Paper_(JEE).pdf*> ❏

### TABLE 1
**Grading Checklist for Written Reports[1]**

Student: _____     Project Phase: _____
Date: _____     Evaluator: _____

|  | Max. | Score | Comments |
|---|---|---|---|
| **Technical Content (60%)** |  |  |  |
| Abstract clearly identifies purpose and summarizes principal content | 10 |  |  |
| Introduction demonstrates thorough knowledge of relevant background and prior work | 15 |  |  |
| Analysis and discussion demonstrate good subject mastery | 30 |  |  |
| Summary and conclusions appropriate and complete | 5 |  |  |
| **Organization (10%)** |  |  |  |
| Distinct introduction, body, conclusions | 5 |  |  |
| Content clearly and logically organized, good transitions | 5 |  |  |
| **Presentation (20%)** |  |  |  |
| Correct spelling, grammar, and syntax | 10 |  |  |
| Clear and easy to read | 10 |  |  |
| **Quality of Layout and Graphics (10%)** | 10 |  |  |
| **TOTAL SCORE** | 100 |  |  |

### TABLE 2
**Excerpt from a Peer Rating Rubric for Team Projects[2]**

| Your name |  |  |  |  |  |
|---|---|---|---|---|---|
|  |  |  |  |  | TEAM NAME / NUMBER: |
|  |  |  |  |  | ← Write the names of the people on your team. |
|  |  |  |  |  | Contributing to the Team's Work |
| 5 | 5 | 5 | 5 | 5 | • Does more or higher-quality work than expected. |
|  |  |  |  |  | • Makes important contributions that improve the team's work. |
|  |  |  |  |  | • Helps teammates who are having difficulty completing their work. |
| 4 | 4 | 4 | 4 | 4 | Demonstrates behaviors described in both 3 and 5. |
| 3 | 3 | 3 | 3 | 3 | • Completes a fair share of the team's work with acceptable quality. |
|  |  |  |  |  | • Keeps commitments and completes assignments on time. |
|  |  |  |  |  | • Helps teammates who are having difficulty when it is easy or important. |
| 2 | 2 | 2 | 2 | 2 | Demonstrates behaviors described in both 1 and 3. |
| 1 | 1 | 1 | 1 | 1 | • Does not do a fair share of the team's work. Delivers sloppy or incomplete work. |
|  |  |  |  |  | • Misses deadlines. Is late, unprepared, or absent for team meetings. |
|  |  |  |  |  | • Does not assist teammates. Quits if the work becomes difficult. |
|  |  |  |  |  | Interacting with Teammates |
| 5 | 5 | 5 | 5 | 5 | • … |