Teaching Engineering in Japan: Frustrations and Observations

Nigel Ward
Faculty of Engineering
University of Tokyo

Two years ago, as a new faculty member, I was not doing a good job of teaching. With some effort, techniques from how-to-books[1] and the accumulation of experience the situation has improved somewhat. Trying to do better, however, I have sometimes been frustrated by the formal organization of undergraduate education.

I made up a list of some of my frustrations, in the form of proposals for change. To find out the students' opinions, I created a survey (included below) where each proposal was to be ranked from 1 (terrible) thru 4 (indifferent) to 7 (excellent). This survey was distributed to the 141 graduating seniors in the Mechanical Engineering, Engineering Synthesis, and Mechano-Informatics Departments at the University of Tokyo; 29 responded. Professor Fujioka later gave the same survey to a class of 65 sophomores. It would also be interesting to poll a group of faculty on these questions; this I leave as an exercise for the reader.

Before presenting the results, two comments on my title. First, I refer to "frustrations", not "problems", because I'm sure that some of these reflect my personal lack of understanding of the way things work, rather than point up real issues. In particular, it might well be that the current expectations of Japanese society are met best by the present way of doing things. Indeed, adopting the proposals below could weaken the strong points of the education system. Second, I'm generalizing from my experiences to Japanese practice in general, although I don't know to what extent this is valid.

I'm not sure how important these points are in the grand scheme of things. Improving graduate education probably should have a higher priority; this would mean, primarily, making the Japanese university a better environment for research, so that the faculty can be better role models, as researchers ... but that's a story for another day. And of course, more basic issues, like providing more student housing, and making more scholarships available, are also important.

機械系三学科４年生各位

Undergraduate Mechanical Engineering Education

Opinion Survey

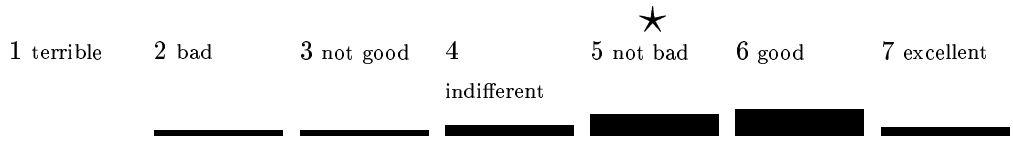
Instructions

Here are some proposals that would make engineering education here more like that at the University of Michigan (my undergraduate school). Please rank each proposal by circling the number that corresponds to your opinion. Base your judgements on whether you consider it a good thing in principle, not on whether it could be easily implemented here.

[1] I recommend *Mastering the Techniques of Teaching* (Joseph Lowman, Jossey-Bass Publishers, 1984, ISBN 1-55542-221-7) and *Improving Your Classroom Teaching* (Marryellen Weimer, Sage Publications, 1993, ISBN 0-8039-4976-6).

1. At Michigan most courses meet 2 or 3 times a week, and students only take 4 or 5 courses per semester. This makes each course cover more material and cover it more thoroughly. Here students take more courses per semester, but each has less class time.

   Proposal: Students should take fewer courses, and each should meet more often.



2. At Michigan most undergraduate courses are 50 minutes long. The advantage of shorter classes is that there is less problem of being overwhelmed by too much new information in one dose. Here all classes are 90 minutes long.

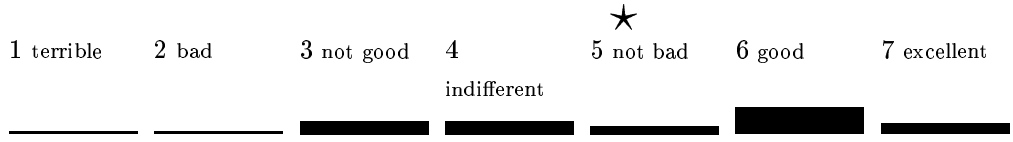
   Proposal: Class length should be reduced to 50 minutes (and classes should meet more frequently).

3. At Michigan, textbooks are relatively more important. In many classes, students learn primarily from the textbook, and class time is spent reviewing and supplementing the information in the textbook. Here many lectures have no textbooks assigned at all.

   Proposal: Textbooks should be assigned for most classes.

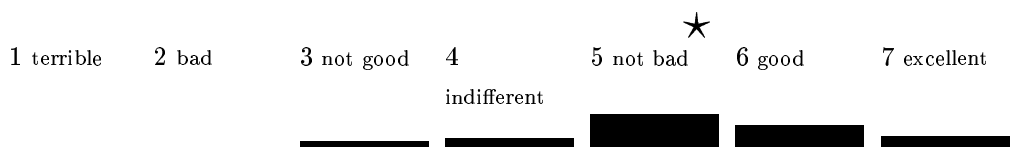
4. At Michigan no one takes attendance. The reasoning is that, if you do the homework and can pass the tests, it doesn't matter much if you listened to the lectures or studied on your own. Here attendance is taken in some classes.

   Proposal: Attendance should not be taken.



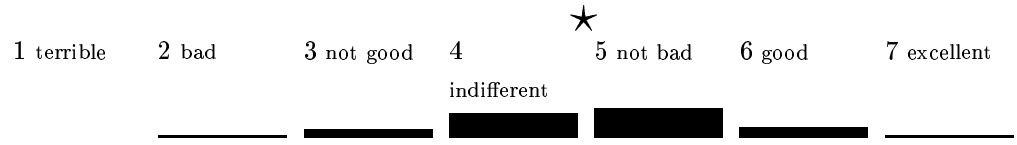
5. At Michigan virtually all engineering classes have homework. In fact, for every hour of class time, students are expected to spend 3 hours outside of class preparing (mostly doing homework and reading the textbook). The rationale is that, for most things, solving problems yourself is a better way to learn than just listening to lectures.

   Proposal: There should be relatively more homework assignments (and less lecture time).



6. At Michigan for many classes the homework is graded by "readers", that is, advanced undergraduate or graduate students. This allows there to be more homework assignments and more careful grading.

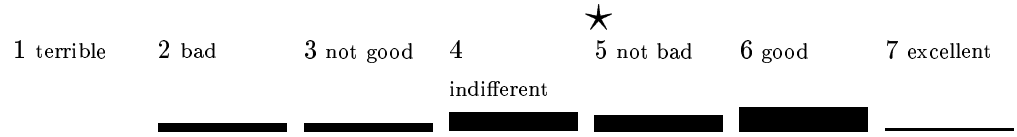
   Proposal: Homework should be graded by readers.



⋆ avg= 4.5

7. Many classes at Michigan are partly taught by "teaching assistants" (TAs) who are graduate students. The advantage is that this allows smaller classes even for first year students — a typical pattern is for a large lecture class (50–200 students) to have lectures by a professor 3 times a week, and to meet for discussion lad by a TA once a week. The disadvantage is that some TAs are inexperienced at teaching and do a bad job. Here teaching assistants are rarely used.

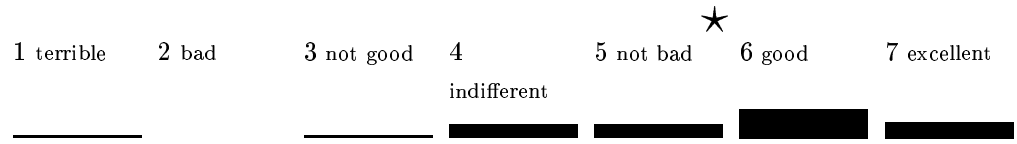
   Proposal: More classes should have teaching assistants.



⋆ avg= 4.6

8. At Michigan each professor has "office hours", that is, a fixed time each week when he is in his office and available to answer questions, give help with homework, or give general advice.

   Proposal: All professors should have office hours.



⋆ avg= 5.4

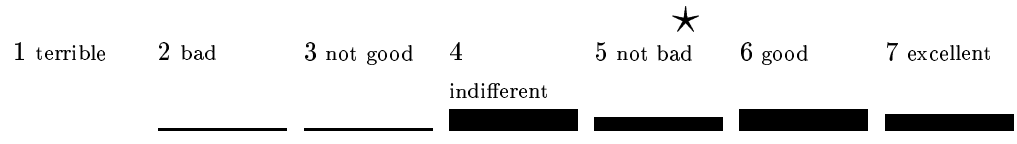
9. At Michigan there is only one professor per course. Many courses here are taught by two professors.

   Proposal: Each course should be taught by one professor.

⋆ avg= 4.2

10. At Michigan many undergraduates take one or two graduate courses for credit. Here this is not possible.

    Proposal: Undergraduates should be allowed to take graduate courses for credit.



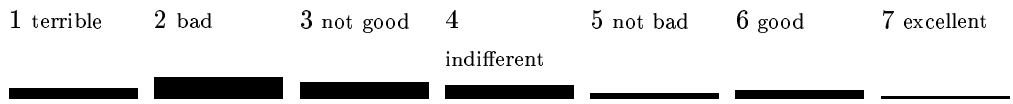
⋆ avg= 5.2

11. At Michigan, after one month students must decide which courses they want to take. If, later in the semester, they abandon a course, they get a failing grade. Here there is no penalty for dropping a course at the end of the semester.

    Proposal: There should be a deadline for dropping courses, early in the semester.

⋆

⋆ avg= 3.2

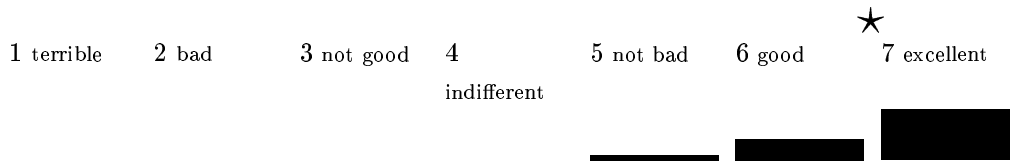


12. At Michigan each class has a "syllabus", namely a one-page summary of:

    - course goals (i.e., what the professor intends to teach, and why)
    - outline of topics and course schedule
    - outline of assignments

    These are available to students to use when choosing which courses to take. Here the only standard information is the short description in the course catalog.

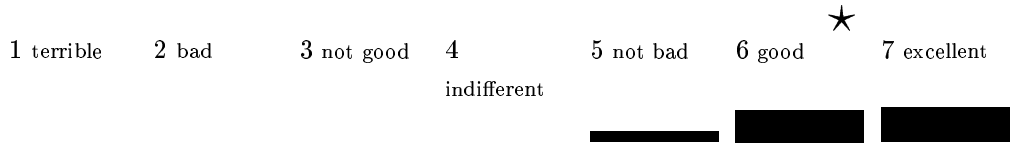
    Proposal: There should be a syllabus for each class.



⋆ avg= 6.5

13. At Michigan, at the end of the semester each course is evaluated by the students who took it. The results of the course evaluation are published. Professors use them to see how to improve teaching. Students use them to help decide which courses to take.

    Proposal: There should be course evaluations.



⋆ avg= 6.3

14. In America, graduate school admissions is based mostly on 4 things: reputation of the undergraduate school, scores on national tests, undergraduate grades, and letters of recommendation (mostly from undergraduate faculty). Because of the last 2, many students work very hard to get good grades and impressing professors. Here graduate school admission is based primarily on scores on the entrance examination.

    Proposal: Course grades and faculty recommendations should be considered in the graduate school admissions process.

⋆ avg= 4.1

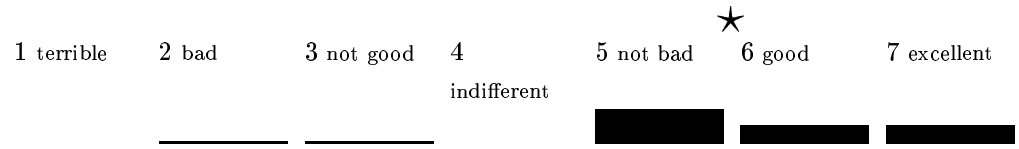
15. At Michigan senior projects are optional. A student who wants to do one has to find a professor willing to be his advisor.

    Proposal: Senior projects should be optional.

⋆ avg= 4.1

16. At Michigan there is an "industrial co-op program": students can work as trainees as part of their education. For the last two years, they spend several months each year working for a company doing things related to their studies. The advantages are that this gives them practical experience, and money. The disadvantage is that this program requires them an extra year to earn the degree.

    Proposal: There should be an industrial co-op program here.



Thank you for your help.