ENGINEERING 100
INSTRUCTORS' MANUAL

DEVELOPED BY
THE SUMMER 2003 ENGINEERING 100 PLANNING TEAM

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1. INTRODUCTION AND COURSE PHILOSOPHY

During the summer of 2003 the Engineering 100, Introduction to Engineering, planning team met to develop materials to assist faculty new to Engineering 100. In this instructors' manual we present the course objectives and outcomes for this course. In addition, we include the levels of achievement expected of Engineering 100 students in meeting these outcomes as a guide for faculty in planning their curriculum. To help them implement the curriculum consistently we have recommended a common custom-published textbook, to be used almost exclusively across sections during the 2003-2004 academic year. To further ensure consistency across sections, we developed guidelines that cover issues such as course structure, grading and exams, and honor code, discipline, and disability policies that are expected to hold across all sections. Finally, suggestions from previous and current Engineering 100 instructors are included in a Best Practices appendix section.

The items mentioned above are presented in the following sections and are available in the master Eng 100 website, http://www.eecs.umich.edu/eng100/site/index.php. The authors are grateful to previous generations of Eng 100 faculty, who developed preliminary versions of many of these materials.

2. DESCRIPTION OF ENGINEERING 100

The following is the proposed formal description of Eng 100, including catalog description, course topics, objectives and outcomes. The college-formatted Step II is included as Appendix A to this manual.

Catalog description

Focused team projects dealing with technical, economic, safety, environmental and social aspects of a real-world engineering problem. Written, oral, and visual communication required within the engineering profession; reporting on the team engineering projects. The role of the engineer in society; engineering ethics. Organization and skills for effective teams.

Course Topics

The following topics are to be covered, at the level indicated by the number of lecture hours.

1. Engineering problem solving (10 hours)
2. Statistics (2 hours)
3. Design (7 hours)
4. Teams (3 hours)
5. Global and societal impacts (2 hours)
6. Ethical decisions (2 hours)
7. Communication skills (16–18 hours)

Course outcomes

Engineering 100 has been designed to meet ABET Program Outcomes a-h, as shown in Table 1

ABET Outcomes	Eng100 coverage
a. An ability to apply knowledge of mathematics, science and engineering	X
b. An ability to design and conduct experiments, as well as to analyze and interpret data	X
c. An ability to design a system, component, or process to meet desired needs	X
d. An ability to function on multi-disciplinary teams	X
e. An ability to identify, formulate, and solve engineering problems	X
f. An understanding of professional and ethical responsibility	X
g. An ability to communicate effectively	X
h The broad education necessary to understand the impact of engineering solutions in a global and societal context	X
i. A recognition of the need for, and an ability to engage in life-long learning	
j. A knowledge of contemporary issues	
k. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.	

Table 1: ABET Outcomes met by Engineering 100

It is expected that after completing Engineering 100, students should be able to perform the course outcomes in Table 2, at a first-year level:

1. Solve engineering problems using project-specific mathematics, engineering, and science concepts. (ABET 3a, e)

2. Analyze, interpret and make decisions about quantitative data using basic concepts of descriptive statistics (mean, median, standard deviation, normal distributions, and mode) and measurement, including issues in: (b)
   a. precision and accuracy;
   b. sample and population;
   c. error and uncertainty.

3. Solve an open-ended design problem by: (c, e)
   a. transforming an open-ended design problem into an answerable one;
   b. breaking down a complex design problem into sub-problems;
   c. determining assumptions involved in solving the design problem;
   d. determining resources that can be used to solve the design problem and ways to obtain these resources;
   e. determining multiple possible design solutions to the design problem;
   f. selecting a design solution using a well-defined method appropriate to the problem domain.

4. Use the following skills in the context of a team-based design project: (d)
   a. develop clearly defined, explicitly agreed-on team goals;
   b. develop and implement a project plan;
   c. conduct effective team meetings;
   d. document team activities;
   e. evaluate how well the team and individual team members are functioning (using team norms and a knowledge of good team practices).

5. Identify the ethical, environmental and other global and societal impacts of engineering practice. (f, h)

6. Engage in an ethical decision-making process, given some engineering situation: (f)
   a. analyze the situation (using a appropriate method or framework);
   b. decide on a course of action (using relevant codes of ethics);
   c. support this decision.

7. Design technical/professional communications by employing the following skills: (g)
   a. analyzing a communication situation so as to determine the audiences and their information needs and a purpose and rhetorical approach for the document or communication;
   b. breaking a communication task into components and employ appropriate strategies at each stage of the communication process (both individually and collaboratively);
   c. writing readable prose, as characterized by well-organized paragraphs, well-constructed sentences, precise and effective use of both non-technical and technical vocabulary, and adequate and appropriate use of transitional devices;
   d. organizing information for oral presentation;
   e. creating clear, accurate graphics that are well integrated into oral and written communications.

8. Deliver well-structured, technically sound communication of the following types: (g)
   a. well-formatted informal and formal written reports.
   b. oral reports, given without notes and with supporting visuals.
   c. Evaluate and effectively construct arguments, using technical content at the first-year level.

Table 2: Engineering 100 Course Outcomes

3. ASSESSMENT: EXPECTED LEVELS OF ACHIEVEMENT

To further define the level at which students are expected to perform the above course objectives, we have specified expected levels of achievement, as well as suggested teaching materials and assessment tools.[1] The levels of achievement, categorized according to levels in Bloom's Taxonomy, are presented below.

Course Outcome 1

Solve engineering problems using project-specific mathematics, engineering, and science concepts. (ABET a, e)

Teach using project specific materials.
Assess using homework sets and exams

Levels of achievement expected:

Application:
- Apply concepts to obtain a numerical solution to a closed-ended problem
- Use knowledge based to develop possible approaches to solve a closed-ended problem

Analysis:
- Identify assumptions needed to solve a closed-ended problem

Course Outcome 2

Analyze, interpret and make decisions about quantitative data using basic concepts of descriptive statistics (mean, median, standard deviation, normal distributions, and mode) and measurement, including issues in: (ABET b)

a. **precision and accuracy;**
b. **sample and population;**
c. **error and uncertainty.**

Teach using chapter in Common Textbook
Assess using homework sets, exams, projects as appropriate

Levels of achievement expected:

Comprehension:
- Define precision and accuracy and the difference between the two
- Define error and uncertainty, their sources, and the difference between the two

Application:
- Use the appropriate tool to solve a statistics problem
- Present solution answers to appropriate level of precision, i.e. using appropriate numbers of significant figures

Analysis:
- Calculate the (mean, median, standard deviation, normal distribution and mode) of a given sample and be able to explain their meaning in terms of the sample

Course Outcome 3

Solve an open-ended design problem by (ABET c, e)

Teach using materials in common textbook
Assess using oral and written project reports

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[1] We are indebted in this work to the article "Engineering Education – Assessment Methodologies and Curricula Innovation – Outcome Attributes" (http://www.engr.pitt.edu/~ec2000/ec2000_downloads.html)

Levels of achievement expected:

3a. Transforming an open-ended design problem into an answerable one;

Analysis:

Analyzes perceived wants and needs to isolate information pertaining to problem definition

Synthesis:

Produces a clear and unambiguous needs statement in a design project

Evaluation:

Assesses/verifies adequacy and consistency of produced problem definition with customer's and societal needs

3b. Breaking down a complex design problem into sub-problems;

Analysis:

Analyzes progress of design in order to revise plan as needed

Synthesis:

Produces a design strategy and uses it to guide a design project
Breaks up problem into subproblems and subtasks

Evaluation:

Evaluates progress by comparing current design state to design plan

3c. Determining assumptions involved in solving the design problem;

Analysis:

Determines appropriate assumptions
Separates facts from assumptions

3d. Determining resources that can be used to solve the design problem and ways to obtain these resources;

Knowledge:

Cites appropriate resources to obtain information for the problem/situation
Defines and describes type of resources needed
Draws upon past knowledge/experience as relevant to problem at hand

Comprehension:

Indicates where additional information is needed
Understands the various methods for information gathering

Application

Uses specified information gathering method to obtain information
Designs and conducts data collection efforts

Analysis

Selects appropriate resources needed to gather information
Collects needed information and data

Synthesis

Employs gathered information in design decisions

3e. Determining multiple possible design solutions to the design problem;

Application

Selects and performs appropriate idea generation methods in a design project

Synthesis

Integrates generated ideas into design plan
Generates ideas creatively or ad hoc where established methods fail

3f. Selecting a design solution using a well-defined method appropriate to the problem domain.

Comprehension

Recognizes feasible candidates among a selection of candidates, using a specified method

Course Outcome 4

Use the following skills in the context of a team-based design project (ABET d)

Teach using readings, topic specific handouts, examples, role playing exercises, and/or workshops.

Assess using in-class exercises, homework assignments, exam questions, peer and self assessments, instructor conferences with teams, and/or team writing assignments.

Levels of achievement expected (by suboutcome):

4a. Develop clearly defined, explicitly agreed-on team goals;

Comprehension:

Understand the meaning of team objectives, team decision making processes, and team norms (or team rules of behavior)

Application:

Create a team charter or contract, possibly stating the team's objectives, decision-making process, and norms / rules of behavior.

4b. Develop and implement a project plan;

Application:

Break down project into task priorities, assign task responsibilities to team members, and set deadlines (e.g. Gantt charts).

4c. Conduct effective team meetings;

Application:

Understand meeting roles
Make and follow an agenda
Use meeting time productively.
Actively participate and encourage all team members to actively participate in meetings.
Respect and actively encourage diversity of ideas and opinions.
Maintain a record of decisions and actions items.

4d. Document team activities;

Application:

Keep a project log or notebook (a comprehensive history of the design process as it proceeds).

4e. Evaluate how well the team and individual team members are functioning (using team norms and a knowledge of good team practices).

Application:

Assess whether the team is abiding by the team's norms.
Recognize common types of team breakdowns and be able to try possible solutions.
Provide and accept honest and constructive feedback to and from teammates.

Course Outcome 5

Identify the ethical, environmental and other global and societal impacts of engineering practice. (ABET f, h)

Teach using readings, including chapter 2 of Holtzapple and Reece's *Foundations of Engineering, 2nd ed.,* case studies, scenarios and web pages;
Assess using written assignments and exams.

Levels of achievement expected:

Comprehension:

Recognize the ethical, environmental, global and societal concerns involved in engineering practice.

Analysis:
Grasp the ramifications of an ethical problem.

Course Outcome 6

Engage in an ethical decision-making process, given some engineering situation. (ABET f)

a. **Analyze the situation (using an appropriate method or framework);**
b. **Decide on a course of action (using relevant codes of ethics);**
c. **support this decision.**

Teach using University of Michigan College of Engineering Honor Code and another professional code, such as that of the NSPE; teach further using lectures, readings, case studies, scenarios and web pages;
Assess using written assignments and exams.

Levels of achievement expected:

Comprehension:
Use a knowledge base to identify ethical, environmental, global and societal concerns in engineering practice.
Analysis:
Grasp the ramifications of an ethical problem.
Synthesis:
Propose a defensible solution to an ethical problem using an ethical framework and relevant professional codes.

Course Outcome 7

Design technical/professional communications by employing the following skills: (ABET g)

7a. Analyzing a communication situation so as to determine the audiences and their information needs and a purpose and rhetorical approach for the document or communication;
Teach using both general and specific project material
Assess using individual and team papers, oral presentations, class exercises, or exams

Levels of achievement expected:

Comprehension:
Understand that there are multiple audiences in most professional situations
Analysis:
Identify various audiences for specific communication situations
Application:
Use understanding of audiences and their needs to design appropriate communication.

7b. Breaking a communication task into components and employ appropriate strategies at each stage of the communication process, both individually and collaboratively;
Teach the following topics using both general and specific project material:

- the rhetorical process of invention (finding information; finding or creating arguments)
- the arrangement of information and sub-arguments into an appropriate overall argument
- the writing process for individuals and teams

Assess using individual and team papers, oral presentations, class exercises, or exams

Levels of achievement expected:

Comprehension:

Understand how to use a top-down strategy to break a task into its components

Application:

Design a strategy for completing each team oral presentation and report.

7c. Writing readable prose, as characterized by well-organized paragraphs, well-constructed sentences, precise and effective use of both non-technical and technical vocabulary, and adequate and appropriate use of transitional devices;

Teach the following topics using both general and specific project material:

- cohesion,
- paragraph construction, including the use of transitional devices
- concision,
- appropriate vocabulary for the audiences

Assess using individual and team papers, oral presentations, class exercises, or exams

Levels of achievement expected:

Comprehension:

Understand principles of cohesion, paragraph construction, concision, appropriate vocabulary for the audience.

Analysis:

Be able to identify when good principles are violated in specific instances.

Application:

Use understanding of these principles to design appropriate communication

7d. Organizing information for oral presentations;

Teach the following topics using both general and specific project material:

- appropriate overall organization,
- use of text-based and graphical visual aids,
- design of overheads or presentation slides,
- choreography of team movements and speaker change-over,
- predictions of and preparation for questions

Assess using individual and team outlines, oral presentations, class exercises, or exams

Levels of achievement expected:

Comprehension:

Understand major differences between oral and written communication

Understand recommended principles for overall organization, use of text-based and graphical visual aids, design of overheads or presentation slides, choreography of team movements and speaker change-over, predictions of and preparation for questions

Analysis:

Be able to identify when good principles are violated in specific instances.

Application:

Use understanding of these principles to design appropriate communication

7e. Creating clear, accurate graphics that are well integrated into oral and written communications.

Teach the following topics using both general and specific project material:

- qualitative graphics (charts/graphs),
- representational graphics (diagrams/illustrations),
- tables

Assess using individual and team papers, class exercises, or exams

Levels of achievement expected:

Comprehension:

Understanding principles of sound graphic design relevant to qualitative and representational graphics and to tables.

Analysis:

Be able to identify when good principles are violated in specific instances.
Be able to identify the purpose of a visual aid
Be able to choose an appropriate form or type for display of visual material

Application:

Use understanding of these principles to design appropriate graphical elements in written and oral communication

Course Outcome 8

Deliver well-structured, technically sound communication of the following types: (ABET g)

8a. Deliver well-structured, technically sound, and well-formatted informal and formal written reports.

Teach using both general and specific project material addressing the following topics:

- Overview
  - Foreword
  - Summary
- Discussion/proof section
  - Supporting arguments for claims in the summary
  - Functions of elaboration, qualification, implication, support
  - Use of sub-headings
  - General to particular structure
  - References
- Documentation
  - Appendices
  - Other sources of information

Assess using individual and team papers, class exercises, or exams

Levels of achievement expected:

Comprehension:

Understand the following basic report structure

- Overview
- Discussion /proof section, including references
- Documentation

Understand the principles and conventions for formatting and structuring the sections outlined in "Teach" above.

Analysis:

Identify when structural or formatting principles are violated in specific instances

Application:

Use understanding of these principles to design appropriate sections of written reports

Synthesis:

Create appropriate and complete written reports

8b. Deliver well-structured, technically sound, and well-formatted oral reports, given without notes and with supporting visuals.

Teach the following using both general and specific project material:

- Oral presentation structure
- Effective design of overheads or presentations slides, including the use of short bullet points (not sentences), consistent format across the presentation, and large enough text and visuals for adequate visibility
- Adequate delivery of the oral presentation

Assess using individual and team oral presentation rehearsals, final oral presentations, or class exercises

Levels of achievement expected:

Comprehension:

Understand basic principles for the items under “Teach”

Analysis:

Be able to identify when structural or formatting principles are violated in specific instances

Application:

Use understanding of these principles to design and create appropriate sections of oral presentations

Synthesis:

Create appropriate and complete oral presentations

8c. Evaluate and effectively construct arguments, using technical content at the first-year level.

Teach using both general and specific project material to focus on the following:

- Use of criteria
- Possible argument patterns (such as problem-solution and cause-effect) and their implications for a final argument
- Standards of proof

Assess using oral presentation rehearsals, final oral presentations, individual and team papers, class exercises, or exams

Levels of achievement expected:

Comprehension:

Understand the principles for using criteria, argument patterns, and expected standards of proof

Analysis:

Be able to identify when principles are violated in specific instances for using criteria, argument patterns, and standards of proof; evaluate sample arguments correctly

Application/synthesis:

Use understanding of these principles to design and create appropriate arguments

4. COMMON CUSTOM-PUBLISHED TEXTBOOK

To help implement the curriculum consistently across sections, we have recommended a common custom-published textbook, including chapters from the following two textbooks:

Holtzapple and Reece, *Foundations of Engineering,* 2nd ed. (HR)

Rubin, *Introduction to Engineering and the Environment*

The specific chapters, in the order presented, are shown in Table 3.

HR Chapter 1	The Engineer
HR Chapter 5	Introduction to Design
HR Chapter 7	Numbers
HR Chapter 9	Statistics
HR Chapter 2	Engineering Ethics
Rubin Chapter 1	Engineering and the Environment
HR Appendix A	Unit Conversions
HR Appendix B	NSPE Code of Ethics
HR Appendix C	z table

Table 3 – Common Textbook Chapters

Copies of the two textbooks, as well as of Graedel and Allenby, *Design for Environment*, and Schinzinger and Martin, *Introduction to Engineering Ethics* were made available to all faculty.

5. CONSISTENCY GUIDELINES

The following guidelines have been developed to ensure consistency across the various sections of Eng 100:[2]

Course Structure

1. The course is project based, with one major project.
2. The course consists of 1000 total points.
3. The course will be graded on a straight scale
4. Individual points constitute 60 ± 5% of the total number of points
5. Exams make up a total of 300-400 points (final and 1-2 midterms).
6. Written assignments total about 30-35 pages, including 2 major team reports, of which one is a final project report.
7. The writing focus is on technical reports for mixed audiences, including managers.
8. There will be a minimum of two individual writing assignments graded for Technical Communication exclusive of in-class exams.
9. There are at least 2 oral presentations, including at least 1 formally graded
10. Oral presentations focus on management-style briefings for mixed audiences, including managers
11. There is an integration of technical issues, research, results, etc., into reports and oral presentations. The content of the reports and oral presentations is largely the technical material in the course.
12. There is an integration of ethical, environmental and other global/societal considerations into project where appropriate

Grading

13. Regular meetings as necessary will be held with course staff to ensure equitable grading and content within sections.
14. The course faculty will be involved in a significant portion of the grading, in particular, the major student products.
15. Tutoring/feedback/practice sessions will be held with each student team before at least one oral presentation.

Exams

16. Exams will cover at least some technical and communication content.
17. All instructional staff will be responsible for grading exams.

Textbook

18. Each section will require the common Eng. 100 custom-published textbook and may require one or more additional texts or course packs.

[2] These guidelines are an update of the document “Engineering 100: Course Consistency Issues, Final, Approved Decision for Fall 1999”

6. HONOR CODE POLICIES

The following policies were agreed upon and will be used by all sections.

Engineering 100 Honor Code Policy

The College of Engineering Honor Code is a statement of ethical standards by which the faculty and students of the College of Engineering conduct themselves. You are bound by the provisions of the Honor Code; ignorance of it is no excuse to infringe upon it. The Engineering 100 student is expected to read the Honor Code. For details regarding the University of Michigan's College of Engineering Honor Code, please see the following URL: http://www.crlt.umich.edu/honor.html#Engr

Among other things, the Honor Code forbids plagiarism and dishonesty. To plagiarize is to take and pass off as one's own the ideas, writings, etc. of another.[3] [4]The Honor Code itself states: "It is dishonorable to receive credit for work which is not the result of one's own efforts." Therefore, all individual assignments must be prepared by the student whose assignment it is, and each student must do his or her fair share of teamwork.

However, in Engineering 100 you are often expected to co-author reports and assignments as well as edit team deliverables. This may raise questions about what constitutes ethical use of other people's work and what crosses the line into plagiarism. Therefore, the faculty of Engineering 100 have promulgated the following rules to help you work cooperatively in this course without violation of the Honor Code. These rules cover common situations, and you are expected to follow them and any modifications of them introduced by your instructors. These rules are not exhaustive: situations arise which cannot be foreseen. In such cases, as in any other, guidance will be sought in the language and spirit of the Honor Code itself.

Plagiarism Policies

1. No individual or team may hand in as his or its report or assignment any product that includes work done by any other party; accordingly, no individual or team may have anyone else help draft the language or prepare the answers of a report or assignment.
2. An individual may consult with other students concerning the conceptualization of an assignment of any kind, but that individual must generate the written solution by working alone.
3. Individual team members may co-author team reports and other team assignments with other students on an Engineering 100 team. All of the co-authors' names must appear on all copies of any team or group assignment. If a student's name appears on a team report, this means that student has fairly contributed to it; if you allow a teammate's name to appear on a team report to which he or she has not fairly contributed, then you have breached the honor code.
4. Individuals and teams may enlist the aid of another person to proof-read assignments for grammar, spelling or punctuation unless this has been expressly forbidden.
5. No individual or team may use information from any source, whether published or not, unless that source is credited.

[4] Slightly adapted from *Webster's New Universal Unabridged Dictionary*, Deluxe 2nd Ed., Cleveland: New World Dictionaries/Simon & Schuster, 1983.

Participation in Teamwork

Each student must do his or her fair share of teamwork. Each student must take part in all aspects of a team project: research, data gathering, data analysis, and drafting and revision of written text.

Handling Data with Integrity

You may not falsify or misrepresent methods, data, results, or conclusions, regardless of their source.

Unfair Advantage

You may not possess, look at, use, or in any way derive advantage from the solutions of homework or exams prepared in prior years, whether these solutions were former students' work products or solutions that have been made available by faculty, unless the Engineering 100 faculty expressly allows the use of such materials.

7. DISCIPLINE AND DISABILITY POLICIES

Two additional policies, regarding discipline and disability were also developed.

Discipline Policy

We expect you to complete all work on time. If you miss a deadline on an individual assignment you will be penalized in accordance with the policy established by this Engineering 100 section.

If you miss a deadline for an exam, a final oral presentation, or a written report on a project without a prior arrangement with the Engineering 100 lead faculty, you will likely receive a zero for that assignment or exam. Depending on the importance of the project, this may result in a failing grade for the class.

In some circumstances, we may accept legitimate excuses and make arrangements for you to turn in the work late. If you know in advance that there may be a conflict that will keep you from completing an assignment on time, you must discuss your options with your discussion leader or a faculty member before the assignment is due. You may be asked to furnish a written note that has been signed by an identifiable person who will vouch to the truth of the circumstances surrounding the excuse. Any situation which results in a protracted absence from school or seriously jeopardizes your ability to complete course work will be referred to the Engineering Advising Center for consideration.

Acceptable excuses:

1. Medical emergency.
2. Death in the family
3. Other excuses deemed acceptable by your lead instructors.

Unacceptable excuses: *(This is not an exhaustive list; it is illustrative.)*

1. Homework, etc., was due in another class and the student did not have time to finish the Engineering 100 assignment.
2. The student does not get along with his team members and so decided not to show up for team meetings.
3. The student was nervous about making an oral presentation and skipped that part.
4. The student had a serious computer problem.
5. The student's printer broke down.

Contested Grade Policy

If you are not satisfied with a grade, you can request that we take another look at it. However, such requests must be accompanied by a memorandum from you explaining why you think your work merits a different grade and this must be submitted within a week after you get your assignment back. After a week, no re-grade requests will be accepted.

Disability Policy

If you have any disability as defined under the Americans with Disabilities Act that might interfere with your ability to turn in assignments on time or in the form required, please contact your lead instructors and the Office of Students with Disabilities at the start of the term so that arrangements can be made to accommodate you.

8. SUMMARY

The foregoing document was produced with three purposes in mind: first, to clarify and define the nature of Engineering 100; second, to demonstrate the place and value of Engineering 100 in the engineering curriculum, particularly with regard to ABET requirements; and third, to provide all the information and guidance that a faculty member new to the course would need to produce an Engineering 100 section consistent with those already in existence. A collateral benefit of this effort has been increased cohesion among the current 100 faculty and consistency among the courses they are offering in the current semester.

APPENDICES

Appendix A: Step II, Course Description

Appendix B: Best Practices

Appendix A: Step II, Course Description

Appendix B: Best Practices

Reflections and suggestions for newcomers to the course. This is intended to be a "living document" that refects the insights and ideas of current and future instructors of Engineering 100. We hope to continue adding to it.

Pedagogy

Interactive lectures are a useful tool for engaging the students when the material permits it. Let's face it—it's not particularly valuable to ask students their opinion of the 2nd Law of Thermodynamics, e.g., and sometimes they just need to absorb information as quickly as possible without interruptions. Some topics, however, do lend themselves to some input from the class (see "5-minute problems," below) and can be presented with that in mind. Graphics usually elicit comments that lead to reasonably fruitful discussion. Ethical issues and environmental questions get lots of response. Although it can be difficult to shape the resultant discussions and as a result they often wander pretty far from the intended focus, students seem to feel that they benefit from such sessions. I think they can, if the discussions are actually less open-ended than they seem.

Almost nothing I've tried has produced much interaction in lectures on the subject of writing, though I have my own versions of 5-minute problems in Tech Comm, too. It may be that talk about communication, particularly writing, is never going to engender any really interested response from inexperienced writers. In general, instruction in writing isn't suited to lecture format—as we all know—but we're stuck with it. It seems to me that most of us accommodate by doing as much of the instruction in writing/tech comm in our discussion sections and during our office hours as possible.

Even when we're successful at eliciting interactive responses from students, we often have a problem that many students have complained of to me: the halls we lecture in are large, and the students in one area usually can't hear the ones in another. Since the live wires often sit up close and the less-interested ones far in the back, interaction frequently involves the first four or five rows and entirely excludes the kids who are least engaged anyway. It's artificial and cumbersome to make the students come to the lectern to ask or answer questions, but if anyone besides the questioner and instructor is to get anything from the exchange, some repetition/paraphrase is almost always necessary. I suppose everyone knows that, but I sometimes have to remind myself of it; once an exchange gets going, the temptation is certainly to let it go.

Five-minute problems work really well in our class (though we more commonly have 2- or 3- minute problems, in fact). George often presents a new concept by setting up a question and having the students talk with their neighbors about possible answers. If the answer involves drawing something, as when he asks what shape might best resist a particular type of force, e.g., he'll have students come forward. If it just involves reasoning something out (e.g., here's a picture of a fracture; what crystalline structure do you think characterizes the material involved?), he'll take two or three different answers and let the students decide which is best. Either way, most of them get involved.

For tech comm, I've had some success throwing flawed sentences up on the overhead and getting the kids to confer on how to edit them, but in the end that sort of thing really involves only a small number of students. I have used, and will use again, a 'non-pop-quiz' in which I require the kids to answer very quickly a series of simple interpretive questions (i.e., 'how many people is this sentence talking about?'; 'who's the *he* in the second half of this sentence?; 'which event occurred first?')about a series of deliberately poorly-constructed and ambiguously-worded statements. I then collect the answers and use them to demonstrate the problem of ambiguity, since the answers are always pretty wildly inconsistent. It might not work for anyone else, but it works pretty well for me.

Journals are not useful for teaching technical writing, in my opinion, and in fact can be counterproductive (my bias). I don't like the idea of not marking errors that would constitute problems of clarity or credibility in any formal writing—you can tell students that journal writing is different from writing for another kind of audience, but I still see it as a unintentional reinforcement of the usual student view that unedited, minimally understandable writing is sufficient for most purposes.

They can be useful for other purposes—allowing instructors to gauge the students' understanding of engineering concepts or see their reactions to the class and instructors. For the latter purpose I prefer face-to-face interaction and the occasional anonymous in-class survey, myself. For the former, I'm not at all sure that the time and effort required to read and respond to them are adequately repaid, pedagogically, and I wonder whether the students feel the same way about their time and effort (assuming they put much in, another thing I wonder about, especially when the journals are graded essentially on a 'full marks for doing anything' system). I'd be interested in seeing the remarks of someone who favors journals and has used them successfully, since I recognize that my view may sound a little jaundiced.

Feedback to students is something they value and we can profit from pedagogically. Probably most people already offer it and have numerous venues for doing so; our major ones are post-exam Q & A sessions (see "Interactions with students" below) with solutions to the problems on overheads and post-presentation debriefings based on the comments on their assessment sheets. George always gives them stats on the exam scores, too, so that each student knows where he stands in relation to the overall performance of the class.

Interaction with students

A number of students have told me that Engin 100 was the only class they had in their first or second term in which they actually got to know a real professor, and many have said that the discussion section was the only small class they had all year. If part of our job is to help first-year students learn how to be successful COE students, we should take advantage of this relative intimacy. Some instructors take photos of their classes early on (when the teams are formed, usually) so that they can learn the kids' names quickly. Others do activities in the first few classes that foster a degree of familiarity—we have used lightweight, entertaining puzzles with some success; this term we're going to have a team-building exercise early in the term for the same purpose. We always use the first discussion session (or at least a part of it) for self-introductions, as I expect most people do. It does seem that students respond very well, for the most part, to efforts to get to know them.

Office hours seem pretty crucial to me. The best instruction is one-to-one, especially in writing. Unfortunately, it's often the top students who make the most use of the time—not that we don't want to help them, but I'd rather see the kid who's struggling to pass than the kid who wants to make a 96 instead of a 94. I urge kids to come in if they're having trouble, and so does George, but in general the really endangered ones avoid us until late in the term, when their situation may be desperate. I'd like to know how other instructors manage to get those kids in, short of requiring conferences (also useful).

Practically speaking, office hours work best right after class, for us—many of the kids aren't on NC except for Engin 100. We survey them in the beginning and set office hours according to when most of them are available. They seem to appreciate the effort, small though it is.

I encourage several members of a team to come in together when they're working on their projects, since we want them to be compiling and editing as a team. Usually teams designate the 'best writer,' who then comes in and gets suggestions for cleaning up the messier sections—I'll deal with one if one is what I get, but I'd like to know how other instructors handle that situation.

How do other instructors deal with requests from students to 'look over my report/ paper/homework and e-mail me'? I tell kids that they must bring stuff in so that we can talk about it, but e-mail does seem to be supplanting face-to-face contact in a lot of realms, and students do often seem to prefer it. Of course we can (and do) tell them that we don't provide editing service, but I'm talking about cases wherein the students do genuinely have larger questions about a writing task. The whole question of how to use e-mail exchanges is bothersome to me, and I wonder what other instructors' policies are:

do you tell students that they must come in to follow up an e-mailed query? Do you tell them how quickly they may expect an answer? Do you limit the kinds of things they may ask via e-mail? Do you comment on their e-mails regarding tone, clarity, etc.?

Class management

Class prizes sound like a good idea, but they've been problematical for us for several reasons. First, the major work of the class hasn't been submitted at the point at which prizes would have to be awarded if the class is going to participate in the whole thing. I know that some instructors get around this by awarding the prize for something completed earlier in the term. We put so much emphasis on the final project that I kind of hate to diminish it (apparently) by awarding the prize for something else, myself. Second, the major work in the class is team-based, and often even the best projects are produced by a team with some deadwood. It's a little galling to hand out a prize to someone who's gotten a free ride on his teammate's efforts. Of course, that's going to be true throughout their college years and probably their professional lives as well, but I'm still troubled by it. How do other instructors handle this problem?

We gave in-class 'Best Presentation' awards (of some freebie discretionary points) one year, and it was a disaster. A couple of teams argued bitterly (and publicly!) that the teams we'd chosen had errors or flaws in their presentations (the litigants had presented on the same topics), and the whole thing became unpleasant. Maybe among kids as competitive as these, awards of any sort are always going to produce reactions of that sort, but at least if the prize is a mug and a certificate, maybe they won't come to blows.

On the whole, I don't know that I like giving class prizes in Engin 100 all that well, though I do like it in TC 215. I concede that it may encourage some students, but I'm not sure how effectively it does that, even. How about the rest of you?

Closed-book exams are, it seems to me, demanded in our case by the course goal (in our outcomes) that they learn some hard-core engineering during Engin 100, but perhaps in some classes they can demonstrating their learning equally well with open-book exams. For tech comm, it's mostly irrelevant; we're not testing them on a body of knowledge, for the most part. I do require that they learn a small number of things by heart, and I do test for those items on a closed-book exam.

Hours outside class are covered *passim*. I would add here only the comment that pre-presentation rehearsals, though terribly time-consuming, pay off very well and seem to be greatly appreciated by the students.

Help with reports before due date also pays off. I myself can see no argument against giving it in whatever quantity the students require or seek. I've commented above on some practical problems associated with the process. What are other instructors' thoughts and experience?

SPECIFIC SUGGESTIONS TO ATTACH TO "OUTCOMES"

4. Use the following (unlisted) skills in the context of a team-based design project.

We have discussed and agreed on a few things that teams should know how to do, including the following:

- Set an agenda
- Conduct a meeting
- Keep records or minutes
- Apportion roles
- Reach decisions
- Analyze their own behavior and assess their progress
- Produce a complex product

We go about trying to do that, in our section, by making assignments that require teams to demonstrate their abilities to take minutes, e.g., by doing various kinds of team self-assessment over the course of the term, and by feedback based on our observation of the teams' dynamics in rehearsals, their performance on the project, and their comments about their own interactions.

We give a modest amount of formal instruction on the nature of teamwork, typical problems that arise, reasonable expectations for the development of the team, and so forth. We do at least one team-building exercise in discussion and are adding at least one more this term.

5. Engage in an ethical decision-making process, given some engineering situation.

We agreed that we will present, in some form, at least a couple of ethical systems and teach the students to analyze ethical questions in light of them. For most of us, this probably means a lecture. Some instructors have expressed feelings (positive or negative) about the COE's ethics site (essentially the Steneck 6-step ethics cookbook). It can be useful, depending on what assessment tool is being used in the class. We use it as a kind of checklist for analysis of a problem. We then use exam questions to ascertain that they know how to perform some rudimentary analysis of an ethical dilemma quickly, but we use an essay (and part of another essay, this term) to assess their ability to synthesize and think more deeply about a problem in ethics. So far we've used the usual cherry-picking case, but other scenarios might be more effective, and I would welcome some suggestions from other instructors for good material.

We agreed that we would cover a professional code, both from the standpoint of its pronouncements on ethical questions and as a way of communicating to the students what professional responsibility is. Assessment of that, for us, is on the basis of the essay that the students write, in which they are asked to incorporate relevant canons.

7. Design technical/professional communications by employing the following (unlisted) skills.

We discussed and agreed upon the following as necessary or at least very important skills:

- Analyzing an audience and its needs
- Making rhetorical and lexical choices based on the analysis of the audience
- Constructing paragraphs that contain topic sentences, adequate supporting detail, and links to surrounding paragraphs (moving from the general to the particular)
- Using material obtained from written and/or electronic sources, with appropriate credit
- Incorporating graphics of various types into written texts, with adequate explanation
- Supplying sufficient and appropriate documentation

Does anyone recall other specific points that we agreed to cover?

We teach the first two points primarily via lectures; the remainder we teach in workshops. Of course much of the teaching has to be done through specific responses to the work they submit; I often write up fairly lengthy responses to problems that I see in large numbers of papers and append them to the evaluation sheet or e-mail them to the class at large.

Our assessment of all of these is divided between exam questions/tasks, homework assignments, and (above all) the written reports and essays they submit.

8. Deliver well-structured, technically sound communication of the following types: Informal and formal written reports; Oral reports without notes and with supporting visuals.

We are all in agreement that we will use a standard format, but we did not settle on an Engin 100 style, as far as I know. Many of us recommend APA style for citations; that's what we do in our section. For format, we use the guidelines in the Olsen and Huckin text. We assess these only as a part of the written reports. If any instructors have a particularly useful way of teaching or assessing the details of physical report features/format, I'd be glad to know of it.

9. Evaluate and effectively construct arguments, using technical content at the first-year level.

We agreed that we are not bound to a particular model or approach. Toulmin has proven to be useful for many instructors, but it's often taught in a stripped-down version. We agreed that students should be able to do the following:

- Recognize the elements of a sound argument (premises, support, conclusion)
- Recognize the major logical fallacies and/or fallacious reasoning
- Recognize the major kinds of appeals and be able to choose among them appropriately

We present these points in lecture, but the bulk of the instruction occurs when we work with the students on their ethics essay. This term we are incorporating a second argumentative essay into the course. Assessment will rest largely on these two written assignments; we also have exam questions requiring students to identify elements of an argument and/or recast a poorly constructed argument.