Thinking about the Scheduling of the Introduction to Engineering Syllabus: Using a Just-in-Time Approach

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Abstract

The Introduction to Engineering course at Clemson (1 semester hour) has undergone significant change in the past year to become Introduction to Engineering and Science. This paper describes how this significant change was managed in terms of the course schedule. The timing of various course components was carefully planned for maximum effectiveness. A description of the new course and the factors considered in its scheduling are discussed. The events affecting the timing of course topics is discussed, including registration dates, advising needs, and the coordination with other courses such chemistry and calculus.

Introduction

Clemson's General Engineering program has coordinated the common first-year engineering curriculum since 1985.[1] A closer relationship with the sciences has developed as a result of a reorganization that created the College of Engineering and Science in 1995.[2] Most recently, this relationship led to the addition of introductory science content and perspective to the Introduction to Engineering course to create an Introduction to Engineering and Science course.[3] The course in this new format is required of all students in the General Engineering program, but is only recommended at this time for students who enter in a science major. It is hoped that this new course format will retain more students in technical majors—and thus still within the College—even if they leave engineering.

The addition of content and perspective from the sciences was the impetus behind a complete overhaul of the course content and schedule. The process of selecting content to be added or removed is described, but this is rarely transferable to other institutions—the reasons for including one course element over another vary too greatly and removing content can be a charged issue. What is transferable is the process by which the curriculum was ordered. Careful planning considered not only the logical internal order of the course content, but also factors external to the course, such as exams in mathematics and chemistry courses and registration for spring courses.

The Course Schedule in Fall 2000

In order to discuss the changes in content and scheduling that were implemented for the fall 2001 semester, the course topics and schedule for the fall 2000 semester (prior to including content from the sciences) are shown below. The course is not offered in the spring semester.

Table 1. Fall 2000 Course Schedule for Clemson's Introduction to Engineering

Week, Class	Topic (2 classes/week, labeled a & b)
1a.	Syllabus review (half week)
2a.	Clemson computer system (half class gets this)
2b.	Overview of engineering majors at Clemson University assign teams (half of class gets this) / Minidesign #1 assigned
3	Learning Styles Inventory (night – 1 class, 2 hours)
3a.	Teams and Team Skills
3b.	Intro to General Engineering
4	Begin Departmental Presentations
4a.	Biosystems Engineering
4b.	Ceramic & Materials Engineering
5	Self Directed Search (night – 1 class, 1 hour)
5a.	Minidesign #1 demonstration in class/ Minidesign #2 assigned
5b.	Chemical Engineering
6a.	Civil Engineering
6b.	Electrical & Computer Engineering
7a.	Industrial Engineering
7b.	Mechanical Engineering
8a.	Evaluation of Departmental Presentations / Tour scheduling begins Review of Writing Technical Reports/ Content/ Format
8b.	Cooperative Education
9a.	Minidesign #2 demonstration in class/assign Minidesign #3
9b.	International Experiences
10	Tours Begin
10a.	Library Skills
10b.	Student Panel
11a.	Ethics
11b.	Registration Review (Registration begins this week)
12	Fall Break – students work on projects, classes do not meet
13a.	Units and Dimensions
13b.	Estimation of Answers
14	Thanksgiving—students work on projects, classes do not meet
15a.	Minidesign #3 Demonstration in Class
15b.	Course Evaluation
16	Grade review, meetings with instructor

Clearly, a significant focus in this class is a series of departmental presentations (one for each engineering department). Each of the departments that gave presentations also gave a tour during the semester. Tours were conducted in the evenings, so students registered for time slots when they could attend three required tours.

"Minidesigns" are projects that generally require a team of four students to solve an open-ended problem. The projects typically one of two types: a) proving or demonstrating laws and b) measuring things. The student panel provides first-year students a chance to get advice and reassurance from juniors and seniors.

The Cognitive Profile Inventory (CPI) determines a subset of the Myers-Briggs indices (N/S and T/F) and focuses on the most appropriate strategies for learning and studying for people of each of the four resulting types.[4] The Self-Directed Search (SDS) uses a student's preferences and talents to find the three-letter Holland summary code associated with the careers where the student will most likely have success and interest.[5] In Fall 2000, the CPI and SDS were administered in evening sessions.

Classes do not formally meet for the rest of the week of Clemson's Fall break and the beginning of Thanksgiving week. In addition to accommodating project work, these "days off" have traditionally been viewed as a trade-off for the formal meetings (the tours and the two instruments) that occur in the evenings.

The Objectives and Decisions in Creating the Fall 2001 Schedule

The addition of content and perspective from the sciences was the primary objective of the schedule change, but there were other objectives as well. The list below shows the specific objectives related to that addition as well as other objectives.

- Add presentations by science departments (Chemistry, Geological Sciences, Mathematical Sciences, and Physics) (Computer Science did not to participate)
- Add tours of the science departments
- Maximize the impact by delivering information when students need it most
- Reduce evening responsibilities of students
- Increase the prominence of ethics in the course
- Complete all science presentations before the science tours begin so students can make an informed selection
- Complete all engineering presentations before the engineering tours begin so students can make an informed selection
- Finish any topics important to helping students make registration decisions prior to registration (week #11)

Add tours, reschedule instruments. Complicating the scheduling process is the interaction of some of these objectives. It was important to us to reduce the evening responsibilities for a

number of reasons: students had conflicts with other evening activities, including late labs, student organization meetings, homework, and studying. At the same time, the addition of the sciences to the class would add science tours to the evening commitments. The compromise was to add the science tours in the evening, but reschedule the two instruments that were previously conducted in evening sessions into class time. This was acceptable because each instrument had been delivered in large groups at only two different times, making it difficult to reschedule, whereas the tours in each discipline are offered at multiple times on multiple days, allowing for greater scheduling flexibility.

Increase the prominence of ethics in the course. Ethics has been the subject of one class period in the course in the past. We felt that the setting of expectations early in the course (as early as possible in the students' academic career) was of primary importance in order to develop a sense of ethical responsibility. Although the ethics material is apportioned no additional time in the course, we feel that its placement sends a message to students about our expectations and their responsibilities.

Schedule the science presentations early in the semester. Since Clemson has a General Engineering curriculum, student schedules typically do not diverge significantly across the engineering disciplines. In the sciences, however, courses in the major are more prevalent in the second semester of the freshman year. As a result, students majoring in or considering one of the science disciplines need as much information as possible to make a decision before registration. It was therefore important to conduct the science presentations as early as possible—before the engineering presentations—and begin the science tours immediately after all the presentations had been delivered.

Schedule the Cognitive Profile Inventory after the first Chemistry and Math exams. The professional advisors in the General Engineering office have observed that there is a rush of appointments following the first exams in Chemistry and Mathematics. The most popular topic of these appointments is the improvement of study strategies. The Cognitive Profile Inventory has as one of its objectives the improvement of student study strategies, so it was logical to coordinate its administration with these exams early in the semester.

Schedule the student panel just before registration. The student panel gives first-year students a chance to talk to students who have taken (and, in some cases, retaken) the same classes, had the same choices to make, and succeeded. A wide variety of topics are typically discussed, with few restrictions (panel members are asked not to comment on particular faculty). Students ask about co-ops and internships, study abroad, student organizations, and which math course is the hardest.

Schedule career-related material toward the end of the semester. We felt that students needed career-related material most just before they leave for the semester break. This would give students an opportunity to reflect on summer employment that might help them investigate a potential career, and some ambitious students might take the opportunity to talk to employers in their hometown about a summer position.

Computer training eliminated. In the past, it had been of clear importance to introduce students to the campus computer system. In recent years, students seemed to need this less and less. This past semester, students received a step-by-step handout describing some important items, but the computer training session was eliminated. The use of WebCT and the electronic submission of certain assignments help to quickly establish areas where students had difficulties.

Visit from engineering reference librarian eliminated. A number of other first-year classes focus on library skills—including University Success Skills (CU 101) and Composition I (ENGL 101). A large fraction of engineering students receive an introduction to Clemson's library facilities in one of these courses. In addition, it seemed that the students were not yet ready to make use of most of the special resources described by the engineering reference librarian, so that information was not useful to the students at this point in their academics.

Units and dimensions and estimation eliminated. These topics are covered in greater depth in Introduction to Engineering Problem Solving and Design (ENGR 120), the follow-on course in the General Engineering curriculum, so it was decided that they could be removed in order to make space for science content.

Presentations on Co-op and international opportunities combined. These topics were combined not simply to free up space in the course schedule. They are so interrelated that much of the discussion from these topics overlaps. Both presentations were strengthened in this merger.

The resulting schedule is shown in the Appendix.

Conclusions

Some objectives of the course re-design have already been met—broadening the perspective of the course to reflect the merger of engineering and science in a single College at Clemson, and others detailed above. Other objectives cannot be assessed immediately—our efforts to smooth the path for students leaving engineering to remain within the College of Engineering and Science cannot be assessed until students settle into a major.

Certainly, we see room for further improvement. The primary goal is to make the collective presentations more active and hands-on and integrate the minidesign projects into the class better. Some recommendations regarding the scheduling resulted from this past fall's course offering as well—exam dates for large enrollment math and chemistry courses will be shown on the course calendar both to assist the students and to aid instructor planning. The General Engineering advisors also indicated that it would be useful to have the results of the Self-Directed Search career instrument earlier in the semester as a tool for advising and even as a motivator for students to talk to an advisor.

We hope that others may learn from this description of our scheduling process in order to identify ways to help their own students to get more out their early days on the college campus and their selection of a major discipline.

Appendix: ENGR 101 FALL 2001 TOPIC SCHEDULE

WEEK	TOPIC (2 classes/week, called A & B)
1. (half week)-8/22, 8/23	b. Course Instructions
2. 8/27 or 8/28, 8/29 or 8/30	a. Ethics b. Assign teams Teams and Team Skills
3. 9/3 or 9/4, 9/5 or 9/6	a. Intro to General Engineering Minidesign #1 assigned / report format b. Overview of CES majors at Clemson
4. 9/10 or 9/11, 9/12 or 9/13	Departmental Presentations a. #1 Chemistry b. #2 Geological Sciences
5. 9/17 or 9/18, 9/19 or 9/20	Continue Departmental Presentations a. #3 Mathematical Sciences b. Discussion of Cognitive Profile Inventory
6. 9/24 or 9/25, 9/26 or 9/27	Continue Departmental Presentations a. #4 Physics b. Minidesign #1 demonstrated in class / Minidesign #2 assigned

Science tours begin next week. Check the course web site to sign up.

7. 10/1 or 10/2, 10/3 or 10/4	Continue Departmental Presentations a. #5 Textile, Fiber, and Polymer Science b. #6 Biosystems Engineering
8. 10/8 or 10/9, 10/10 or 10/11	***Science department tours begin at night*** Continue Departmental Presentations a. #7 Ceramic & Materials Engineering b. #8 Chemical Engineering
9. 10/15 or 10/16, 10/17 or 10/18	Continue Departmental Presentations a. **Fall Break—NO ENGR 101** b. #9 Civil Engineering

Engineering tours begin next week. Check the course web site to sign up.

10. 10/22 or 10/23, 10/24 or 10/25	Continue Departmental Presentations a. #10 Electrical & Computer Engineering b. #11 Industrial Engineering
11. 10/29 or 10/30, 10/31 or 11/1	***Engineering department tours begin*** a. #12 Mechanical Engineering b. Registration Review (Registration begins this week.)
12. 11/5 or 11/6, 11/7 or 11/8	a. Student panel b. Co-op and International Programs
13. 11/12 or 11/13, 11/14 or 11/15	a. Minidesign #2 demonstrated in class / Minidesign #3 assigned b. Discussion of Self-Directed Search
14. 11/19 or 11/20, (break)	a. Student teams work on Minidesign #3 **NO CLASS MEETINGS THIS WEEK** b. **Thanksgiving holiday**
15. 11/26 or 11/27, 11/28 or 11/29	a. Career Center Services Overview b. Minidesign #3 Demonstration in Class
16. 12/3 or 12/4, 12/5 or 12/6	a. Course evaluation and end-of-semester survey submitted on-line **NO CLASS MEETINGS THIS WEEK**

[1] http://www.ces.clemson.edu/ge/
[2] http://www.ces.clemson.edu/about/history.htm
[3] Current course catalogs still show ENGR 101, but the 2002-2003 Undergraduate Announcements will be changed to reflect the addition of "Introduction to Engineering and Science," College of Engineering and Science (CES) 101.
[4] Krause, Lois Breur, *How We Learn and Why We Don't: Student Survival Guide Using the Cognitive Profile Inventory*, Thomson Learning Custom Publishing, 2000.
[5] http://www.self-directed-search.com/