

Curriculum Makeover for an Introductory Agricultural and Biological Engineering Course

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I. Introduction

The Agricultural and Biological Engineering (ABE) undergraduate program at the University of Florida, like many engineering programs, has only offered upper-division classes for its students. That was true until the 2000 Fall Semester when the first lower division course for engineering students made its debut.

Input from students, industry representatives and faculty, and documentation of other successful lower-division classes indicated the need to introduce ABE students to engineering coursework early in their academic careers. The benefits of early interaction with lower division students have also been discussed by Yokomoto, et al.¹. While retention of ABE students is the primary driving force for this change, offering an introductory course in Agricultural and Biological Engineering has the additional potential of recruiting students who are undecided in selecting an engineering major. In addition to the learning process, a possible benefit to the students is the development of support networks that include ABE classmates, faculty and staff. Such networks, according to Hewitt and Seymour², enable students to persist in their chosen major.

Creation of a lower-division course had been the topic of discussion in the ABE Department for at least two years, but adding a course to an already filled, 128-credit program was not a viable option. The retirement of an ABE Department professor who taught the *Introduction to Design and Analysis for Agricultural Engineers* (ABE 3012) for several years, however, offered the unique opportunity to redesign this junior-level class into a freshman/sophomore-level course without adding any credits to the program.

II. Course Development

Redesigning the course began in the spring of 2000. The course name was changed to *Introduction to Agricultural and Biological Engineering* (ABE 2012C*). It retained such aspects of the old course as highlighting the specializations available in ABE, design and analysis

*Course alphanumeric designation is pending. The “C” means the laboratory is included.

components, problem analysis and solution, introduction to engineering economy, and professional responsibilities and ethics. Major differences included laboratories for hands-on experience, statistics, introduction to instrumentation and measurement equipment, curve fitting, data acquisition, and academic and career planning.

Ten laboratory topics were selected that highlighted the department's three areas of specialization—Agrisystem Engineering, Biological Engineering and Natural Resource Engineering. Specific ABE faculty were contacted and agreed to develop labs that would be introductory in nature. In addition, they were to provide material would motivate and excite students about agricultural and biological engineering while providing them with possible career paths. The laboratory topical areas are listed below.

Laboratories

Heat Transfer	Wind Tunnel/Air Flow Plenum
GIS/GPS	Analysis of Human Variability
Food Processing	Packaging Equipment
Stress-Strain Analysis	Safety in Engineering
Hydrodynamics	Instrumentation & Measurement Equipment

Twelve, 50-minute periods were devoted to conducting laboratories and 28 periods were for lectures. While most of the lecture material was newly developed, notes from teaching an introductory course in engineering were also used. Supplementary material from the reference textbook written by Eide, et al.³ was invaluable.

The condensed course contents for lectures are listed below.

Introduction	Statistics
Overview of ABE	Engineering Economy
Dimensions, Units & Conversions	CR-10 Instrumentation/Programming
Engineering Estimations & Approximations	Academic Planning
Engineering Solutions	Career Planning
Software Tools Useful in Engineering	Professional Issues
Graphical Representation of Technical Information	

Lecture presentations used a combination of Power Point slides and written format (whiteboard/chalkboard). Student input and interaction were promoted as much as possible.

III. Enrollment

This course is required of all ABE students. This particular class had a combination of students who were scheduled to take ABE 3012, essentially juniors, and those who were advised to take the redesigned, lower-division course (ABE 2012C)—sophomore students. Thirty-nine students were initially enrolled in the course. By semesters' end, 36 students remained. This is

approximately double the average number of students enrolled in the course. The breakdown of students based strictly on credit thresholds was 10 sophomores, 15 juniors and 11 seniors. However, according to the level of coursework remaining, a more appropriate classification breakdown was 17 sophomores, 14 juniors and 5 seniors.

IV. Student Survey

A student survey was developed to acquire student input on the course. Names were not required in an effort to receive [honest, pertinent, relevant?] feedback. All students attending class were provided the survey and their names checked on a class roster for credit. The survey included the following response items:

1. I am a ___ Freshman ___ Sophomore ___ Junior ___ Senior
2. What component(s) of this course interested you most?
3. What component(s) of this course interested you least?
4. List possible ways in which the course could be improved.
5. List topics and/or labs you would like to have covered in class (that were not covered).

Students were asked to check their status based upon completion of courses in the ABE curriculum, not based upon credit thresholds.

V. Survey Results

Thirty-one students (86%) completed the survey. According to perceived academic rank, there were 13 sophomores, 14 juniors and 4 seniors who responded. The breakdown according to the items listed follows.

Most Interesting

Sixty eight percent indicated that labs were the most interesting component of the class. Of the labs, the GIS/GPS lab was mentioned most at 32%. Following this was the Food Processing lab (19%) and then the Heat Transfer, Wind Tunnel and Stress-Strain labs at 10% each. Lecture topics were listed by 71% of the students. This included 19% each for Engineering Economy and topics that included information on ABE, and 13% for software used in engineering.

Least Interesting

Identified as least interesting was the CR-10 Instrumentation/Programming by 29% of the students. Poor preparation and execution were listed among the comments. This was followed by Units/Dimensions/Conversions at 19%. Those responding felt this topic had been covered enough in previous courses. Statistics and Engineering Economy were each found least interesting by 16% of students.

Course Improvement

Sixty five percent of the students felt that the lab time needed to be expanded to accommodate longer and more in-depth and more detailed laboratories. Placing notes on the web and more challenging homework were each listed by 6% of the students.

Additional Topics/Labs

Forty two percent listed increase bio-related labs and topics. Twenty three percent of the students wanted to see more information on the ABE major and/or the specializations and 29% identified various labs.

VI. Course Analysis

Overwhelmingly laboratories are in need of the most attention with 68% listing them as most interesting and 65% asking to include more time for labs. The original schedule for ABE 3012 was three, 50-minute lectures per week with no laboratory. This schedule, unfortunately, was already set when students registered for the class. The result was that labs had to be completed within a 50-minute time period or continued during the next scheduled class period. That problem has been remedied. The class, which is taught only in the fall, will have two 50-minute lecture periods and one 2-hour laboratory each week. As such, 50% of the course will be allocated for labs, contrasted with 30% the first time taught. This will accommodate the longer, more in-depth laboratories requested and also provide the opportunity to include additional information about the ABE major and each specialization.

Other comments that deserve attention are those identifying the need for more bio-related topics and/or labs. A majority of students in the ABE curriculum have specified *Biological Engineering* as their specialization. This specialization is relatively new to the ABE program so these responses will result in the identification of additional laboratory and course material needed to generate excitement and maintain interest in the ABE program.

Other worthwhile responses were those regarding the CR-10, data acquisition lecture series. It is clear that to continue with this topic will require detailed and relevant information, clear directions and sound preparation.

Minor other changes are being considered as the result of individual comments and/or suggestions. Engineering Economy for example was both liked—19%-- and disliked—16%. But comments about relevance of examples have provided direction for change. There were also some suggestions for labs, such as the effect of refrigeration on fruit, or microbial decay analysis that have potential merit.

VII. Conclusions

Redesigning a junior-level course into a course for lower division students in the Agricultural and Biological Engineering program is very positive for early interaction with the sophomore and possibly freshmen students in ABE. Students responded most favorably to the laboratories

even under the scheduling constraints that created a “mini-lab” environment. The next time ABE 2012C is taught, the class will be smaller and will consist mostly of sophomore ABE students. This, along with a lab-favorable schedule, student input and having taught one semester of the class, is most likely to result in a better, more improved *Introduction to Agricultural and Biological Engineering* course.

Bibliography

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