

**A New Approach to the Introduction to Technology Course
at a Four Year College of Engineering Technology**

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Abstract:

As part of a National Science Foundation Institution Wide Curriculum reform grant, several freshmen courses in science, mathematics, engineering and technology (SMET) from across the University of Hartford were completely revised with the specific goals of improving the students appreciation of SMET, improving the first year experience, and increasing student retention. Increased faculty participation was also a primary goal. Among these courses was ET111, Introduction to Engineering Technology, which is required of all freshmen students attending the Ward College of Technology. To address these issues the course was completely revised to include a team teaching format, expansion of subject topics to include student academic and social requirements, basic research skills in the form of a research project, demonstrations of scientific principles through “hands on” exercises, use of basic computer analysis techniques, and introduction to industry professionals through monthly seminars. The importance of teamwork was also a focal point of the course. A full presentation of the course outline, the results of several student surveys and a detailed review of several of the more unique aspects of the course will be presented. Overall the student response to the course was quite good and it significantly improved the dialog between the staff, faculty and students.

I. Introduction and Background

A current trend across the country in engineering and technology schools is to enhance the freshmen experience in hopes of improving student attitudes and retaining students beyond the first semester. Many others have produced successful course offerings that attempt to stimulate interest and appreciation of engineering and technology.^{1,2,3,4} Another important student skill, that is a critical asset both in education and in industry, is the ability to work as a team.^{5,6} In order to address these needs for Ward Students, and also incorporate the goals of an NSF Grant on Institution Wide Curriculum Reform (Grant #), the one credit course Introduction to Engineering Technology, which is required of all freshmen, was chosen for revision. The NSF Grant was specifically aimed at the improvement of freshmen attitudes towards science, math, engineering and technology, so ET 111 was the best choice for revision. In addition, the course needed to serve students from a wide range of programs including electronic, mechanical, architectural, computer and audio engineering technology, and needed to be flexible enough to attempt to meet all of their needs and interests. ET 111 originally covered the history of the City of Hartford and the University. It was later changed to include basic unit conversions and mathematics and was taught in a lecture format by a single professor.

Unfortunately, it did not address many of the procedural and practical aspects of University life and, in general, did not meet the specific goals mentioned above. With the award of the NSF Grant on curriculum reform, it was decided that this course should be completely revised.

II. Goals and Objectives of the New Course

In the Spring of 1997, a team which included faculty from mathematics, technical communications and mechanical engineering technology, as well as the director of student services and the director of enrollment was formed, to revise ET 111. The following set of goals were established to guide the team's work:

For the Student:

- *Make students feel comfortable as members of a College and University that works for them.
- *Provide students with the opportunity to acquire the facts, skills and attitudes they need to be successful in attaining their education and career goals.
- *Improve students' appreciation of SMET and professionals in technology and engineering.
- *Expose students to new experiences that will expand their vision of college life and their chosen careers

For the College:

- *Develop more committed learners in diversified programs; instill loyalty to the college, and develop respect and appreciation of others.
- *Motivate students to become more active in planning their education and broadening their cultural perspectives.

Since the course is required of all freshmen at Ward College (approximately 75/year), three sections are ordinarily offered each fall. This has the advantage of keeping the class size relatively small. Under the revision, it was agreed that all three sections would use the revised curriculum and a team teaching format would be used. Each team would consist of a faculty member and a staff member. In an effort to involve as many members of the faculty as possible, three different professors would each have one section. The staff personnel consisted of the Director of Student Services and the Enrollment Manager.

It was also decided that the course would retain its pass/no pass grading format. A grading format was then established to determine the award of a passing grade as follows:

- Attendance is critical; a daily sign in log will be taken.
- The student will be allowed 3 absences
- Three late class arrivals (greater than 10 minutes), will equal 1 absence.
- A technical review of an article is also required to pass.
 - Abstract due week of October 5
 - Final report due December 1 (will not be accepted late)
- Participation in classroom exercises is also required.

The revised course was first offered in the fall of 1997.

III. Fundamental Aspects of the Course

Explanation of the University and Student Responsibilities.

Common complaints among students is that things like registering for classes, finding advisors, staying off probation and keeping their financial aid are too complex. A variety of efforts are done to help resolve these concerns. Each student is given a large storage folder in which they were told to keep all their scheduling and course enrollment information. They are also given many handouts such as a list of advisors with office hours and phone numbers, and the “Bulletin” and “Source,” which describe many of the bureaucratic aspects of the University. Maps of the building are distributed along with all materials necessary to choose a proper plan of study. The graduation, academic performance requirements, and required course completion rates are also reviewed. The importance of staying off probation, and how to do it, is clearly explained. All students then fill out a program worksheet.

Introduction of Students to Faculty.

In order to facilitate dialog between faculty and students, a seminar is presented by the office of Residential Life, at which all Ward Faculty are also required to attend. Both were rewarded with lunch which definitely improves attendance. During the lunch, students are given a sign-off sheet which lists all Ward faculty and staff, and they are required to have no less than five of them sign it. This encouraged students to develop rapport with various individuals at the college whom would play a significant role in their collegial careers. It also eliminated the common complaint of “who is my advisor?”.

Seminars Featuring Industrial Speakers.

Four seminars are held during the course where all the sections met as one group to listen to a presentation by practicing professionals from a variety of ET fields including mechanical, electronic, audio and architectural engineering. The presentations are meant to not only focus on job duties and responsibilities, but also on each presenters personal career path. Following the seminars, interested students meet informally with the speakers.

Hands-On Activities.

Several exercises were developed that were aimed at stressing the importance of teamwork, the use of the scientific method, and mathematical modeling of actual physical processes.

The first exercise focusses on team building by having the students form groups of no more than four which then attempt to construct a free standing tower using only a sheet of 8.5” x 11” paper and a 6” length of tape. The teams are first instructed to develop potential designs of the tower, the review each and select the best one *before* cutting the paper or tape. The importance of letting everyone participate in the design process is stressed. Overall, the students greatly enjoyed this activity, and every team was able to construct at least some form of free standing tower. A record height of 66 inches was achieved.

The next exercise involves the illustration of the scientific method, experimental measurements and Newton's law of gravity. Again the students are divided into teams of two, and each given an instruction handout and data sheet, and a 12 inch ruler. The exercise called, "measurement of human reaction rate", requires one team member to hold the ruler while the other member prepares to "snatch" the ruler when it is dropped. Before the experiment is actually conducted, each student is required to predict at what distance the other student would be able to catch the ruler. They are also asked that if the experiment was repeated, would the distance value be the same, and if not, why? In general, most students usually agree that the distance would be different each time. The experiment is then conducted for 10 drops for each student, and each catch distance is recorded. The students then compute the average and mean and an estimated "acceptable" value of distance that would indicate a valid test had been conducted. They are then posed with the problem: if the weight of the ruler was increased by a factor of 4, what would the new catch distances be? Almost all students predict that the drop distance will increase. The tests are repeated, and much to the students surprise, the catch distance was essentially identical to the unweighted ruler, as is predicted by Newton's law. This is an example of "the expectation violation" principle and serves to illustrate the nature of science and the scientific method. Again, student reaction was excellent.

Finally, a projectile motion experiment is conducted. First, all the governing equations involved in projectile motion analysis are thoroughly reviewed with a detailed handout and several problems being distributed to the students. An actual projectile is then launched with the time of flight and the horizontal travel distance being measured. These values can be used to calculate the initial velocity of the projectile and the maximum height of the flight. The software package MathCAD is introduced aid in calculating and plotting the flight of the projectile, with each student being required to create their own program. This exercise illustrates the importance of mathematics in modeling real world phenomenon.

Research Project.

In an attempt to expose students to various information resources around the campus, a short research paper was also required. It was decided that the report should be kept relatively modest and should encourage interest in their chosen field. Students were instructed to peruse several journals in their field and find an article, of sufficient length and sophistication, that they would review. They were then asked to rewrite the basic premise of the article in their own words, using standard technical paper format. An abstract is required at the mid point of the semester, with the final report due at the end. A complete set of requirements for the report was given to the students on the first day as well as a list of appropriate journals and Internet search resources. A hard copy of the article was also required with the final report.

Substance Abuse Survey.

In order to determine the validity of claims that the University is, or is not, a "party school", and in general take a measure of student activities and attitudes, a substance abuse survey was used. Questions range from whether or not an individual had used drugs in the recent past, what their views of others who do drugs are, and what their impression of both alcohol and drug use on campus was. In general, most students had used and felt it was appropriate to drink alcohol on the order of 5 drinks per week. The use of marijuana was the most common illegal substance with 40% of students indicating they had used in the last month. As for other drugs such as cocaine, crack, and heroine, responses

were less than 5%. In general, students did not feel the University of Hartford should be considered a “party school”. These results were given to the Office of Residential Life for further study. Every effort was made to keep all results anonymous by the use of a standard questionnaire and mixing of all section responses before compiling the results.

A reduced version of the syllabus is included in Appendix A.

IV. Assessment Measures of the First Offering

At the end of the first offering of the course (December 1997), a student survey was given in which students could give short answers to several questions. Three of the questions dealing directly with the course are given below, along with the primary responses and their percentages (note: these are the results from all three sections).

1. What is one aspect of the course you liked? (instructors 25%, technical content 25%, experiments 20%, class atmosphere 10%, team involvement 5%)
2. What is one aspect of the course you did not like? (lack of technical content 30%, lack of letter grade 20%, seminars not dealing with ones field 15%, research paper 10%)
3. How would you rate this course in terms of helping with your academic careers
On a scale of 1 – 10 (average of 6).

In addition a comprehensive survey on student attitudes towards SMET was given at the beginning and end of the semester. This survey was conducted as a part of the University wide NSF grant. Overall, the appreciation of SMET was relatively unchanged.

One of the best assessment measures was the retention rate of freshmen between the first and second semesters, in this case fall of 1997 and spring 1998. Looking back on a 5 year average prior the first offering of the new ET 111, the average attrition rate between the 1st and 2nd semesters was 16%. For the year the new course was offered, this rate dropped to only 8%. The significance of these results will not genuinely be known until the attrition rate is measured for several years following the implementation of the revised course.

V. Lessons Learned from the First Offering of the Revised Course

It was clear that the course needed to be somewhat more technically oriented. In the second offering of the course, the technical content was significantly increased to include extensive sections on advanced equation manipulation, conversions, and an introduction to the mathematics software package, MathCAD 7.0. The students spent one class period using the software package to complete several exercises. MathCAD was then used to model the results from the projectile motion experiment, using the governing equations of motion and basic do-loops. In addition, several pop quizzes were given throughout the semester to ascertain the students level of understanding and aid in presentation of the material.

VI. Future of ET 111

It is widely agreed by both faculty and students that ET 111 has been significantly improved and is a useful part of the curriculum at Ward College. The format adopted in the first two years will continue to be offered in the fall semester.

A significant result of the first year survey was the desire by students for the course to be given a letter grade. It would seem that students are interested in having their performance rated as opposed to simply being given a "pass" or "no-pass" grade. A letter grading system is being proposed to the faculty and if approved, will be adopted in the fall of 1999.

V. Conclusion

The level of student and faculty approval and reaction from the teaching teams would indicate that this revision is a success. Although only based on one years results, the improvement in retention rate is also a positive indication. With its introduction in the Fall of 1997, the revised course goes to great lengths to instill an awareness of student responsibilities at the University, on both social and academic levels. Undoubtedly, new facets of the course will lead to further revisions in years to come. One of the strongest points of the course is the flexibility that is given to the teaching team; they are essentially free to tailor their presentation to fit their own pedagogical styles. Hopefully the course will help to familiarize incoming students with both the academic and social requirements of campus life and help them to attain their career goals.

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HOWARD CANISTRARO

Howard Canistraro is currently the Assistant Dean for Research and Technology at Ward College. He is in charge of the Mechanical and Audio Engineering Technology programs, which have seen a yearly student growth rate of 20% over the last three years. He is also involved in research work on advanced turbine materials for use in jet engines, and holds a patent on a new method of mammo-

graphy which is under development. He received his B.S., M.S. and Ph.D. in Mechanical Engineering from the University of Connecticut and also worked for four years as an engineer at Pratt and Whitney Aircraft.

PHYLIS KATZ

Phylis Katz recently retired from Ward College after teaching over 25 years in the Technical Communications Department. She was responsible for the development of the unique English program which is offered only to Ward Students. This curriculum has been designed to develop technical report writing and communication skills of the graduates, and has received a very positive response from both students and industry. She received her B.A. from Connecticut College, her M.Ed. from the University of Hartford and her M.S. from Rensselaer Polytechnic Institute.

JANICE GIROUARD

Janice Girouard is the Director of Student Services at Ward College. She is responsible for all aspects of student needs in terms of transcripts, degree audits, academic standings and registering for classes. Janice received her B.F.A. from the University of Hartford.

ANN LANKFORD

Ann Lankford is the Director of Enrollment at Ward College. She is responsible for freshmen recruiting, on campus recruiting events, college web site development and alumni relations.

JOAN DANNENHOFFER

Joan Dannenhoffer recently left Ward College after teaching mathematics for three years. She received her B.S. and M.B.A. from Rensselaer Polytechnic Institute and is a registered professional engineer.

Appendix A – Course Outline

Week 1

Introduction to course
Students' introduction to each other
Invitation to convocation

Distribute:

- Instructors phone numbers and Email addresses
- The Bulletin
- The Source
- Advisor list, faculty phone numbers, office numbers and locations
- Release form, sign-collect
- Program worksheet
- Liftoff packet
- Map of East Hall and Campus Grounds
- Storage folder

Explain basic research paper structure, format of citations and references (one page handout on paper style).

Hand out project outline and requirements

Week 2

Explanation of clubs and organizations
Introduce study skills and time management options
Overview of majors and general program of technology
-Encompass all fields - AuET, AET, EET, CHeT, CET, MET and MTC.
-Explain unique structure of Ward College and the ET 111 course
-Explain importance of technical communication

Teamwork Group Project (Paper tower construction)

Week 3

Thursday Seminar (11:30-12:30, E211)
Presentation on residential life
Meet your advisor (**Advisors and Staff**)
College personnel survey – who does what?

Week 4

Discuss add/drop, change of major, requirements for satisfactory academic progress.
Discuss program GPA (overall), GPA in major, min. req. credits, Dean's List, graduation, honors requirements.

Week 5

Discuss stress - academic social, residential , substance abuse issues
(public safety, counseling services, roommate tensions)
Substance abuse survey

Illustration of scientific method: Reaction rate experiment

Week 6

Thursday Seminar (11:30-12:30, E211)
Speaker in field of Audio Engineering Technology

Abstract for project due (Bring to Seminar).

Appendix A (cont.)

Week 7

- Unit conversions
- Dimensioning
- Significant figures
- Equation manipulation
- Calculator Usage

Results presented on substance abuse survey

Week 8

Tuesday Seminar (11:30-12:30, E211)

Speaker in fields of Electronic and Computer Technology

Week 9

Demonstration of Capabilities of the Computer Lab: AutoCAD, MathCAD
Exercise using MathCAD

Week 10

Tuesday Seminar (11:30-12:30, E211)

Speaker – Architectural Engineering Technology

Week of 11

Math/physics link to real world
Modeling (interpreting real world problems)
Review scientific method

Application of Mathematics to Real World Phenomenon – Projectile Motion

Week 12

Use of MathCAD to model projectile motion flight

Week 13

Tuesday Seminar (11:30-12:30, E211)

Speaker in field of Mechanical or Chemical Engineering Technology.

Report on Technology Article Due (HAND IN AT SEMINAR)

NOTE: REPORTS WILL NOT BE ACCEPTED LATE

Week 14

Student evaluation of course
Group discussion of course
Conclusions