

## **Providing Connections Between Lower Tier and Upper Tier Courses at the University**

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### **Introduction**

Perhaps one of the most difficult experiences that freshmen and sophomores face in their initial contacts with the university is the issue of connectedness of lower tier courses (freshman/sophomore) with upper level courses (junior/senior.) The general university curriculum requires a broad range of courses that should be completed before a student reaches the junior and senior years. These courses include humanities, composition, social studies, and a complete set of math, physics, and chemistry courses. Problems can arise when students enter classes where no attempt is made to draw distinct connections between what is being done in those early courses and the courses that will come in the major field. Students become concerned when they are told that they are to simply learn the material because it is “good for them” or that is “to be learned for its own sake.”

Vast numbers of students move through the university system accomplishing all that is asked of them, graduating with seeming relative ease; but when discussion takes place, one discovers that there are underlying difficulties in the system. Students are quick to comment off the record on the difficulty of taking courses that fail to draw connections to either the real world or future courses in the student’s major. They find them baffling in many respects until someone makes the effort to draw logical connections between those initial courses in the academic system and the later major driven classes.

The current work in progress involves that body of students who feel that they have an interest in engineering as a career choice. The group consists of any students who have qualms over what they are being required to learn in courses like mathematics, chemistry, physics, or language arts. The projected initial numbers of students impacted could be as many as 3,000 students with as many as 1,500 added to the group each year. Faculty members and students are being surveyed and spoken to concerning the items to be placed in the brochures and on the web.

### **Current Work**

An effort is being made at Michigan State University to prepare documentation, both written and web based, to provide younger engineering students with connecting strands between courses taken at the lower tier of study and the upper tier. It is a work in progress; and the details of the project, its current status, and future directions will be explored.

The plan is to assist students in identifying career related goals early in their educational experiences through novel and unique interventions that allow students to deliberately and systematically explore career development issues in curricular and co-curricular venues:

- By stimulating career awareness
- By assisting students in decision-making at transition points

The above criteria are addressed within the proposal by providing students with a means to look closely at the connections between their current courses and those courses that will be required of their majors through quick reference materials (brochures) and more detailed materials (website content.) Engineering careers require mathematics, chemistry, physics, and language skills. This project aims to give students devices to use to explain why their lower tier courses have importance in their careers.

Probably the most important aspect of the project is retention. Students who have all the necessary tools to become engineers may fall away from engineering simply because they see no relation between what they seem to be forced to take in the lower tier and required (interesting and valuable) courses in the upper tier. Hopefully by providing these connections, students will be more apt to continue within the engineering area.

Since we see little being done to acquaint students with the actual importance of these early courses with their future work, one would feel that any effort to provide connections would improve the current status of career development services. Many students enter Michigan State University with engineering in general or a specific engineering program in mind. They come enthusiastically searching for that career of the future. Some of these are really on the wrong track, and they will change their directions and hopefully graduate with one of the many other degrees on campus. A certain percentage will forge ahead and successfully complete the engineering degree requirements. But another group will fail to continue what they truly might have accomplished. They will fall away from the engineering areas because little or no effort is made to explain why courses in the freshman and sophomore years have any importance in the courses that they take in the degree programs started in the junior year. This beginning provides students with practical information on the use of their lower tier courses.

These decisions will be performed on a much higher level when students understand the importance of lower tier courses to their major aspirations. The lower tier courses that seem to have the most disconnectedness to upper tier courses are:

- American Thought and Language (the traditional English composition course)
- Humanities
- Interdisciplinary Social Studies
- Mathematics
- Chemistry
- Physics
- Statics
- Thermo-fluids

The current courses being studied for connections to the above are:

- ME 332 – Fluids
- ME 412 Heat Transfer
- ME 451 – Controls
- ME 461 – Vibrations
- ME 371 – Design I
- ME 471 – Design II
- ME 481 – Capstone Design

The project requires that all units within the College of Engineering be a part of the data collection. Each department is being surveyed to gain information on practical uses for the lower tier courses. Hopefully, this will provide departments with a central depository in which to add continuing information for the students' benefit.

Currently upper-tier students are brainstorming personal impressions they have had with their own connections between lower-tier and upper-tier courses. Faculty are also being asked for examples and problems that will show the importance of learning the lower-tier materials.

Some of these collected connections include:

- Statics – Newton's fundamental laws for forces
- Dynamics - Newton's fundamental laws for forces
- Heat Transfer – Analysis of heat transfer phenomena
- Mechanical Design – Newton's Laws
- Control Systems – Newton's Laws of Motion
- Thermodynamics – Power cycle, relationship between properties of fluid
- Matlab
  - a. The solving and graphing of circuits that contain equations with many unknowns
  - b. The solving of differential equations, root loci, and bode plots
  - c. Graphing functions
  - d. Solving matrices and complex equations

Presenting these and much more detailed connections to the lower tier students will hopefully encourage these students to continue in their programs with an increased belief that what they are required to take in those early academic years are valuable for upper level study. Surveys will be given to random freshmen and sophomores during spring semester 2002 to discover if they have found the brochures to be helpful in their perception of the lower tier courses and if they are actually visiting the website and their evaluation of its importance to them. The website will be equipped with a counter to register the numbers of individuals who access the site

### **Continuing Work**

Replication will be a relatively easy process. Other units will be able to see how the lower tier courses that are required within their programs can be connected to upper tier courses. The surveys given to students will be available on the web, along with all the anecdotal material and specific detailing of the connections between lower tier courses and upper tier courses in engineering.

As to future activities, an expansion of the brochure and website focus to facilitate the connection issues with middle and high school courses will be completed. Here the faculty and students can draw the same connecting lines between both lower and upper tier courses for high school students who may be contemplating engineering as their career path.

### **Final Thoughts**

With a new generation of students who have access to massive amounts of data, we are seeing more and more the need to present tangible connections between activities that we feel are basic for learning and the more focused activities that students feel are important to them. When these two bodies of information do not contain visible bridges we must make the connections clear. We can no longer simply require assignments and courses without presenting carefully to students the value and use of these studies to their later careers. It is then the responsibility of every instructor to foster discussion on the varied uses of all that is taught.

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