

## CONFIDENTIAL

Andrew W. Mellon Foundation

FYEE@L Project  
(First Year Experience in Engineering at Lehigh)

Submitted to:

Initiative on the Cost Effective Uses of Technology  
in Teaching

1 May 1999

**The Goal:** This project is intended to enhance the collegiate experience of Lehigh freshman engineering students by accelerating their entry into advanced studies in their specialties and in complementary fields. We propose to design and offer web-based instruction in the freshman year curriculum to high school juniors and seniors who apply to the engineering program at Lehigh. We will design a quasi-experimental study with both qualitative and quantitative measures to determine the behavior of students during the web-based instruction, the extent to which the instruction has prepared them for advanced instruction, and whether this option indeed opens broader learning experiences to them.

**The Rationale: Lehigh's Perspective.** Consistent with question #2 in the Mellon Profile, we are seeking ways to reduce the number of basic courses required of qualified and prepared students to reach advanced materials enabling faculty to teach courses which are more exciting to them and their students. The value-added of a high caliber residential university is to offer students the opportunity to experience exceptional sequences of study that are beyond what is currently in the accepted curriculum. Examples of such sequences are a combined Engineering and Business degree, a semester to year long internship in a major business being a member of a design team, enrolling in advanced foreign language courses which will enhance a career with a global company, and completing a teaching certification program that will qualify the graduate to teach advanced science and mathematics at the high school levels. These options and others like them eventually can become the "regular" curriculum which will transform the nature of engineering education.

**The Rationale: The Student Perspective.** Some options already exist for high school students if they want to be given advanced credit for their high school work. They may achieve criterion scores on the College Board's Advanced Placement Program or they may attain acceptable grades in college courses in which they have enrolled. Lehigh also offers entering freshmen the chance to "test out" of particular courses.

However, many students do not have ready access to advanced placement courses in their high schools. This situation will worsen in the next decade as the current teaching staff retires and

fewer qualified teachers especially in the sciences and mathematics replace them. In addition, many students do not live near institutions of higher education so that they can enroll in college level courses while attending their local high school.

Another method for introducing basic course work and assessing student competency is through Lehigh-designed web-based instruction. For high school students, these courses will give them access to college level subject matter with guided instructional sequences to learn the content. Periodic assessments as well as the final assessment will give students the opportunity to receive feedback on their performance and to improve their skill levels accordingly. The offering of these courses will give students greater access to college level work while they are in high school. The students will have the added advantage of experiencing the high level of expectations of Lehigh's professors, a closer relationship between these courses and the advanced Engineering curriculum and most importantly feedback on their performance as measured by Lehigh standards. The focus of this effort is on student learning and on attaining the requisite competencies to do advanced work as they enter as freshmen.

**The Study Population: Why Engineering?** The Engineering curriculum must meet the rigorous standards of the Accreditation Board for Engineering and Technology. The bachelors degree for all Engineering fields is built on a common core of freshman level courses in sciences (chemistry and physics) and mathematics, english composition and literature, and two introductory engineering courses. Students then select one of thirteen degree programs in Engineering and complete additional courses in the Humanities and Social Sciences. There are six "free" electives in the degree program.

We selected Engineering for the following reasons.

1. We will have a finite group of courses with which to develop the web-based courses. Other than the Engineering courses, students in the College of Arts and Sciences must complete several of them. Thus, we can leverage the results of this project to a wider group of students and faculty.
2. Freshmen Engineering students have the highest average Academic Index (a weighted average of SAT and high school rank) of all entering Lehigh freshman. As a group, these students are the most likely to attempt web-based courses during their high school years.
3. On average, 75% of students entering Engineering as freshmen remain through their degree program. As a result, we will have a fairly intact cohort group to follow throughout their Lehigh career and beyond.

**The Project:** We propose a four phase project as follows:

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|--|---------------------------|
| ⇒ Phase 1 -- Planning  | 1 Jun 1999 -- 30 Nov 1999 |
| ⇒ Phase 2 – Design and Development of First Set of Web-Based Courses | 1 Dec 1999 – 30 Nov 2000  |
| ⇒ Phase 3 – Design and Development of Second Set of Web-             | 1 Dec 2000 – 30 Nov 2001  |

Based Courses, Offering of First Set of Web-Based Courses, Modification of First-Set of Web-Based Courses, Evaluation of Students and Courses

- ⇒ Phase 4 – Offering of Complete Set of Web-Based Courses, Modification of all Web-Based Courses, Evaluation of Students and Courses 1 Dec 2001 – 30 Nov 2004
- ⇒ Phase 5 – Continue Project and Evaluation of Currently Enrolled Students; Conduct Follow-up Study of Graduates 1 Dec 2004 -- Beyond (Lehigh supported)

**Phase 1: Planning.** (1 June 1999 – 30 November 1999). We will develop a full proposal for a five year effort to:

1. determine whether web-based instruction is feasible with entering high school seniors,
2. determine to what extent high school seniors participate in web-based courses,
3. investigate how effective this instruction is in helping students master the basic academic foundation for an Engineering degree program, and
4. learn whether students who participated in web-based course select innovative combinations of advanced work and achieve at a high level of success.

In order to complete a full proposal, we will:

1. evaluate issues of feasibility, capacity, usability, and implementation of a technology-based approach to accelerating the “Freshman Year Experience in Engineering at Lehigh
2. identify working models – if any exist – in Lehigh’s and other educational systems that may inform our process? If so, what can we adopt from them? If not, what have been the major barriers? It seems reasonable to assume that there exist previous and/or concurrent efforts in other areas that might provide interesting and/or useful models for our project. The Planning teams should actively seek these out, and rigorously investigate them. Lehigh is currently in the process of designing web based courses using streaming video.
3. identify early adopters among Lehigh University faculty who have already pursued or who are committed to implementing this approach
4. identify and conduct initial interviews with the potential audience(s) for this project (high school students, their parents, teachers and counselors) in order to determine effective ways in which advertise and engage them in selecting web-based courses for advanced credit.

5. develop a detailed research plan for measuring the effectiveness and efficiency of these courses in accelerating student progress towards advanced study in Engineering and related areas.

The proposal shall answer but not be limited to the following questions.

1. To what extent should professors and/or graduate assistants be available to respond to student questions either through synchronized chat room discussions, or through e-mail?
2. How often should the course require informal and formal assessment and feedback to students?
3. How should students be assessed in order to determine whether they should receive credit for the course? On-line? In a formal testing situation like those used by ETS when administering the Advanced Placement Test? By a portfolio of work submitted to faculty members at Lehigh? The basic issues concern the validity, and reliability of the test and the security of its administration.
4. What should be the criterion for receiving credit in the course?
5. Are there set schedules when a student may take these courses? Or will courses be available to be taken at time and at whatever pace suits the student? The issue concerns the logistics of the availability of faculty members to respond to individual student needs.
6. What is the impact of offering these courses on the student's high school curriculum? Could students receive high school credit for these courses as well as receiving Lehigh advanced credit?

In order to plan our full proposal, we are forming teams of Lehigh faculty members who have expertise and primary responsibility in the following areas.

1. Instructional: These are faculty members who are primarily responsible for the content of the various web-based courses. These faculty members have taught these courses or have collaborated on their content. Some of the professors have already incorporated technology into their teaching but not with the target population of this project.
2. Design/Development: These faculty members will be responsible for conceptualizing, designing, and developing the web-based instructional environment for these courses. These faculty members are using technological approaches in teaching graduate level courses or have developed curriculum units for high school students using technology.
3. High School to College Connection: These faculty members will be responsible for identifying implementation issues concerning high school administrators, teachers, counselors; the students and their parents; and commonly accepted practices in assigning credits to such courses.
4. Research: These faculty members will be responsible for planning and carrying out the quasi-experimental evaluation and research design for the study. We anticipate using a

combination of quantitative and qualitative measures as well as collecting data for development and evaluative purposes at the same time. Careful planning of the design is required in order to minimize competing hypotheses to the results of the project.

Name	Project Group	Faculty Department	Administrative Position @ Lehigh
Jacob Kazakia	Instructional	Engineering Mathematics	
Edward Gallagher	Instructional	English	
Natalie Foster	Instructional	Chemistry	
David Johnson	Instructional	Mathematics	
Tom Hyclack	Instructional	Economics	
Alec Bodzin	Design/Development	Science Education	
Stephen Bronack	Design/Development	Teacher Education	
James DiPerna	Research	School Psychology	
Ron Yoshida	Connections	Educational Psychology	Dean, Education

In addition to the faculty team, we will need to involve the Registrar who will advise the project on issues of assigning credit to students who successfully pass these courses. The Dean of Admissions will advise us on how this program will affect the admissions process, on how to market this program to eligible students. Finally, we will need to identify a set of high school principals, counselors, and students and their parents who will inform us about how we can (a) integrate the FYEE@L courses into the students' regular program as well as after-school schedules, and (b) market this program to them.

In order to administer this program, we will need to appoint a full time director of the project who will be responsible for coordinating the program, and a full time secretary. We also will select one teaching assistant from each of main instructional areas (physics, chemistry, mathematics, english, economics, and engineering), two from the design/development areas (educational technology, teacher education, and science education), and one from research to support of the work of the faculty member. These teaching assistants are important because they often are the instructors of recitation sections, and laboratories.