

Class of '60 support for Educational Technology MITCET Update , July 26, 2011

Background

In response to a charge from the Provost, the MIT Council on Educational Technology (MITCET) is thinking about how MIT could benefit educationally from increasingly available information online and increasingly fast and cheap communication, even globally. *The overall goal is to enable more effective learning. At the Provost's request, we're looking for ideas that would be transformational and could fundamentally enhance and improve the student experience.*

Toward this end, MITCET determined to launch a small set (2-4) of experiments in the fall of 2011 at the undergraduate level, but including one at the graduate level. The MITCET deliberations, informed by several faculty and student focus group meetings have led to *modularity* --- the idea of providing experiences for students that are more modular and flexible both in time (not always organized into one-semester chunks) and geography (not always on campus), as the key areas to address through these experiments.

Funding for these experiments are being provided through the generous support of the Class of '60 in addition to resources from the Office of Educational Innovation and Technology and the Teaching Learning Lab.

MITCET has reviewed initial proposals from Course 6, Mechanical Engineering, Chemistry and ESD and **selected Chemistry and Mechanical Engineering for the fall '11 experiments.** These are described below in brief.

The Engineering Systems Division (ESD) proposal for modularized content, scale the reach of Logistics Systems Course is currently being further reviewed and a decision will be made by August 10, 2011. (FY12)
EECS has initiated set of modularity activities that it expects will lead to a proposal for a substantive experiment and proposal to the MITCET in late Fall 2011. (FY12)

MITCET is working with MISTI and students to develop specific proposals around international experiences. (FY12). MITCET is also considering a School-wide initiative based on current projects.(FY12)

Selected Experiments

1. Chemistry: Chemistry Bridge Project: Modules for greater efficiency and efficacy.

Lead Faculty: Prof. John M. Essigmann

Goal/Statement of Work: Create web-based, video-intensive, user-friendly bridges between modular concepts in early-stage courses (5.11x, 5.12, 5.60 and 5.07) and the same concepts in (a) upper level courses in chemistry and other disciplines (e.g., Biology, Chem. E., etc.) and (b) specific experiments in laboratory courses.

The Chemistry Bridge Project identifies a set of concepts that have been traditional challenges for learners of chemistry and provides multiple paths toward the understanding of those concepts. The multiple paths are multi-media explanatory “bridges” to other courses where the same or similar information is presented in a different context that may be more easily grasped by the learner. If this approach works in the proposed educational experiment, the framework created could be expanded within chemistry and even between chemistry and many other disciplines. The goal, overall, is to make learning more efficient and a more satisfying experience for the learner and, as a bonus, to reduce frustration on the part of the teacher.

Expected Outcomes and Program Evaluation

- Students will learn faster and better in their fundamental courses in chemistry.
- Expect that early stage successes will propagate into greater success throughout the undergraduate experience in chemistry, and in the disciplines that rely upon chemistry as part of their foundation

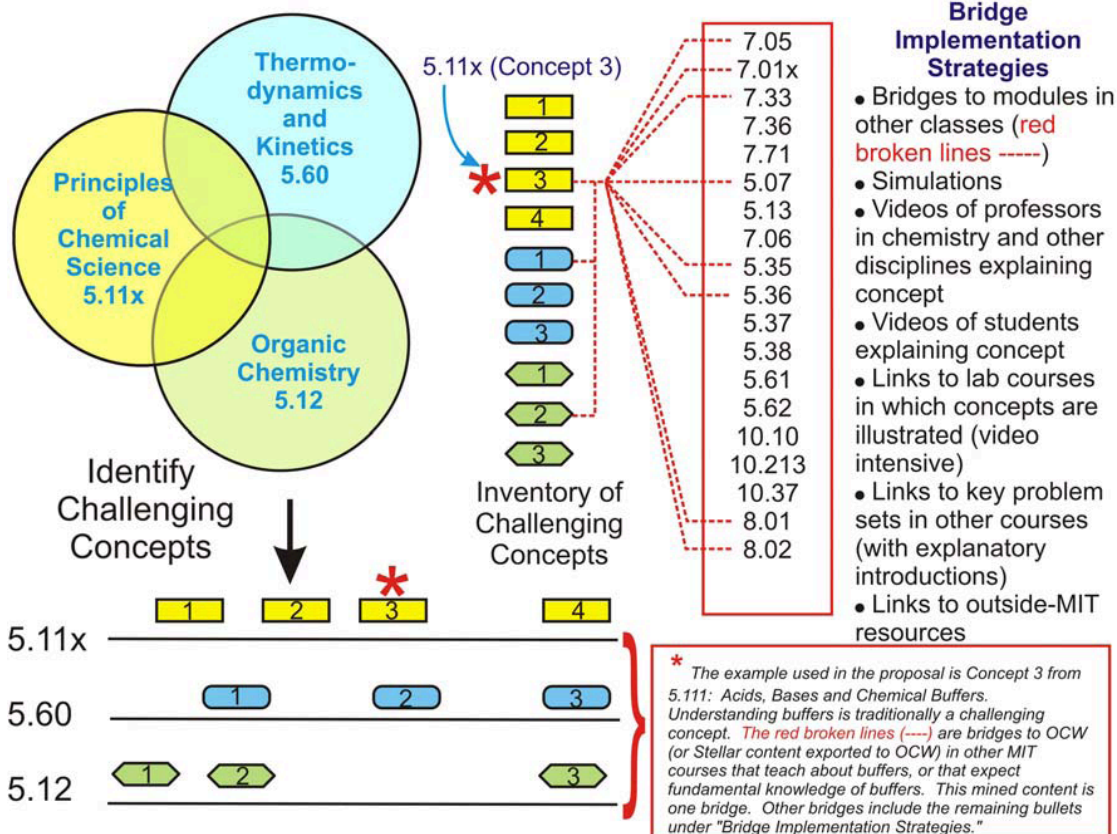


Figure 1. The Chemistry Bridge Project.

Budget 7/1/11 - 6/30/12

Personnel Per year cost

George Zaidan Producer 50% effort (2.5 days per week - \$450 per day)	\$54,000
Project Manager	
Erika Lowden OCW Liaison 25% effort per week	\$8,076.92
Fall Semester (18 weeks)	
UROPS 5 per each of 3 areas 15 UROPS @\$12/hour/5 hr. per week	
Spring Semester (18 weeks)	\$16,200
2 per each of 3 areas 6 UROPS @\$12/hour/5 hr. per week	\$6480
Total (Chemistry)	\$ 84,757
TLL Evaluation / Assessment**	
OEIT, Other Educational Technology **(est.)	\$20,000
Total (MITCET)	\$104, 000

2. ME: Mechanical Engineering

Lead Faculty: Prof. Gareth McKinley. Prof. Mary Boyce.

Goal/Statement of Work: Modularize 2.002 “Mechanics and Materials II” so that the existing pedagogic content can be delivered in this new modular format immediately (Spring 2012).

The pedagogical content of this course is already subdivided into six discrete, but logically- connected topics with associated laboratory demonstrations and investigations. These would form the basis of the planned modular components, which might be considered to be (i) Linear elasticity; (ii) Plasticity; (iii) Failure (Fatigue and Fracture), and (iv) Creep and Viscoelasticity. The faculty participants will determine the optimal parsing during the summer of 2011. Each module might be viewed as a discrete topic with clearly stated learning goals, assessment methodologies and common notation. Each module will consist of development of the key disciplinary domain knowledge and one or more illustrative experiment or demonstration which can either be performed *in vivo* or *in silico* through simulations, video and generation of suitable idealized data sets. Preparation of this content would involve the faculty, laboratory instructor and OEIT personnel and could be readily disseminated via OpenCourseWare if desired. The same content is thus delivered for students in residence or traveling internationally. During the delivery phase of this educational experiment, funds would be requested for one additional TA who would provide live online chat (via Skype, Stellar’s message boarding facilities or other platform to be identified) at specified hours.

The net gain and benefits of this new approach would be assessed using customized remote-specific questions that would be part of the online end-of-term assessment. This rapid feedback can be used to adjust and revise technical content of modules as needed as well as to collect data required for future ABET visits.

The ability to deliver some of our key core undergraduate courses remotely and asynchronously in a modular fashion would greatly enhance the ability to develop such international experiences that would be available to all of our 460 undergraduates e.g. extended MISTI experiences.

The possibility of a revised CME exchange program (in conjunction with the Cambridge University Engineering Department (CUED)) is being explored, in which MIT students only spend one MIT semester (their junior spring

semester) at Cambridge, corresponding to the Lent and Easter terms at Cambridge. This is expected to be markedly more popular with MIT students, many of whom are reticent to spend their entire junior year abroad, especially when they are asked to apply in January of their sophomore year and they have only just identified a host department and found a home at MIT. It is easy to see that such a system could be extended across MIT to other “junior semester abroad” experiences involving other top global universities where the assessment schemes and systems may be even more radically different to MIT’s.

Additional funds (including matching funds provided by the department) will be sought to develop virtual laboratory content (simulations and video-based visualization of existing demonstration labs) as well as associated technical support material for remote study) and to begin the modularization of a more complex two-semester sequence that forms an integral part of the junior year for most ME students (2.005/2.006 “Thermal Fluids Engineering I, II”. Having coherent content for 2.002, 2.005 and 2.006 available online will benefit not only our students traveling away from MIT, but also all of our residential ME students who will be able to make use of the modular content as review material during senior capstone design projects and senior thesis preparation

Budget.

2 faculty @ 0.5month per faculty each summer (2 months total support) for preparing modular instructional materials

\$27,000 (incl. EB)

2.002 Instructor @ 1 month; preparation of videotaped demonstrations and virtual experiment data

\$16,000

(incl. EB)

Additional TA for online live chat, educational support of distance education

\$37,000

OEIT Development of technology elements for 2.002 curriculum delivery**

TLL Assessment** (Est.)

\$20,000

Total Cost MITCET (Est)

\$100,000

+ Department Matching Contributions

2.002 Instructor @ 0.5month Summer 2011	\$4,000
2.002 Instructor @ 0.5month Summer 201	\$4,000
Lecture/Demo materials and supplies Summer/Fall 2011	\$5,000
4 faculty @ 0.25month each (1 month total) to develop modularization plans for 2.005/6 and strategic planning of modularity concepts/MISTI MechE delivery Summer 2011	\$20,000 (incl. EB)
Total Department Contribution	\$33,000
Est. Overall Cost	\$133,000

** MITCET has currently allocated \$20k per project for Technology and Assessment based

MITCET has also appointed teams comprising council members and other staff specialists to monitor/facilitate projects as follows:

MITCET team for ME: Vijay Kumar, Daniel Hastings, Eric Klopfer, Hal Ableson and Jim Orlin

MITCET Team for Chemistry: Hal Abelson, Cec D'Oliviera, Diana Henderson, Troy Van Vooris and Vijay Kumar

A schedule of meetings of the PIs of the projects with MITCET is being established. A series of joint meetings of the project participants is also planned to identify common issues of interest , share strategies and solutions.

Professor Daniel Hastings, Chair, MITCET
Professor Hal Abelson, Co-Chair, MITCET
Dr. M. S. Vijay Kumar, Executive Officer, MITCET