A Proposal to the MIT Provost
Developing Interactive Student-Engaged Learning Course Models at MIT
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Background: CECI was launched in 1991 as a soft money research center with the mission to use educational technology to improve learning at MIT. TEAL and iLabs, the two most successful iCampus/d’Arbeloff projects, were managed at CECI. These projects have had national and international impact. CECI’s projects have dramatically improved the education of MIT students in TEAL Physics (600 students per semester over ~7 years), in Course 1.00 (150 students per semester over 7 years), and in 6.002, 6.012 and 6.720 through iLabs (~3000 MIT students in roughly 13 years and an additional 4000 students worldwide). The Center has built successful collaborations with international partners from East and West Africa, China, India, Singapore, South America, Australia, and Europe.

CECI is presently facing an uncertain future because of funding difficulties. We feel that CECI’s proven capabilities as a developer of successful educational innovation at MIT should not be lost. To that end, we propose that MIT provide funding over two years to maintain CECI’s capabilities, at an annual level of ~$700,000. In that two-year period CECI can play a central role in positioning MIT as an international leader in educational technology. We will continue to write proposals for external funding that will complement this internal project. Beyond this two-year period we feel that CECI will again be self-sustaining.

Vision: Our belief is that the future of residential education lies in interactive student-engaged learning. The passive content now provided in large lectures to hundreds of students will in the future be presented in a dynamic interactive form over the Web, with immediate assessment of student progress built in. Face-to-face interaction with other students and faculty, which is central to the residential experience, will take place in classrooms designed to maximize collaboration and student engagement. Presentation of the material will take place through live demonstrations, interactive video, and experiments, both online and in the classroom. CECI can fuse the innovative research of diverse groups on campus, e.g. the Media Lab, OCW, OEIT, The Center for Mobile Learning, preventing research from being “siloed”. Among these organizations, CECI is uniquely placed to develop reference implementations, at scale, providing a framework that can be adopted across the Institute.

Exemplar Courses: One of the courses we will focus on is 8.02 TEAL, which is among the largest if not the largest course taught at the Institute. John Belcher, Director of CECI, is co-administrator of the large on term TEAL version of 8.02 this spring. TEAL was developed in early 2000’s, and the last decade has seen dramatic growth in the use of new web technologies. We want to apply these new technologies to more actively engage students both inside and outside of the classroom. The current course format does too much passive pushing of material
during class time, with uneven outcomes for the students because of variations in the styles of the instructors. We can remove that variability by transitioning passive content presentation to interactive online sessions, preparing the students for active engagement with faculty and other students in the classroom. The immediate short-term goal would be to study ways to reduce scheduled face time in 8.02, from 5 hours per week to 3-4 hours per week. The important concepts would be conveyed by graded online exercises that the students would have to complete before class. We would simultaneously reevaluate the current experiments in 8.02 to determine the optimum mix between introducing online labs (iLabs) into 8.02 and the current in class experiments. We would develop 3D simulations that complement the experiments to help students visualize the underlying phenomena that often are inherently three dimensional, and explore the possibility of interactive physics visualizations on small form factor devices like smart phones with the new Center for Mobile Learning led by Hal Abelson, Eric Klopfer, and Mitch Resnick. The software architect for this effort, Andrew McKinney, played a significant role in the development of the TEAL visualization engine, TEALSim. Most importantly, we will explore new web technologies for fostering collaboration between students.

Developing and implementing these technologies for 8.02 would serve as an exemplar for any MIT course. Wherever possible we would make the framework for delivery of the material dual-purpose so that it can be used as part of an online course if desired. We will simultaneously study the applicability of this model to 6.002. The effort with 6.002 would be exploratory, whereas with 8.02 we are aiming at changes in the large freshmen course at the end of two years.

We are not proposing a research effort--there is already a vast amount of educational research which bears on how to be more effective in our educational process at MIT. But these studies are based on small experiments, and rarely if ever see wide-spread implementation. Small pilot studies are easy, what is much more difficult is any meaningful adoption in a large scale context. This is what CECI is good at and has a proven track record in: large scale implementation.

Capabilities of CECI: CECI’s successes have built on the depth and complementarities of the core staff’s skills in object oriented and web programming, database development, multimedia, remote instrumentation, tablet computing, 2D and 3D visualization, and artificial intelligence techniques. Since 2000, the Center has provided 94 graduate students and 105 undergraduates with thesis topics and/or research assistantships and UROPs.