Massachusetts Institute of Technology

TASK FORCE ON THE UNDERGRADUATE EDUCATIONAL COMMONS

MacVicar Day 2005:
What Should We Achieve in a Four-Year MIT Education?

Task Force "Working Principles of an MIT Education" [*draft]:

In the early stages of its deliberations, the Task Force developed a set of working principles about MIT's educational philosophy in order to frame its review of the General Institute Requirements. What does our faculty expect all students to develop as a consequence of their MIT education?

- **A Persistent Passion for Learning**
- **Intellectual Diversity**
- **An Innovative Approach to Core Knowledge**
- **Collaborative Learning**
- **Education for Responsible Leadership**

Fuller descriptions of these principles are available at the Task Force website http://web.mit.edu/committees/edcommons.

More recently, Task Force members have agreed on a brief but fairly complete draft statement of the educational goals that clearly identify what is unique about an MIT undergraduate education:

Task Force Goals for an MIT Education [draft]:

> **"An MIT education is one grounded in science and technology that ignites a passion for learning, provides the intellectual and personal foundations for future development, and illuminates the breadth, depth and diversity of human knowledge and experience, in order to enable each student to develop a personal, coherent intellectual identity."**

Excerpts from the Draft Report of the Task Force Subcommittee on the Humanities, Arts, and Social Sciences Experience

"Goals and assumptions underlying a redesign of the freshman HASS experience:

"The overall goal of the HASS Requirement is to expose students to a variety of intellectual traditions outside of engineering, natural science, and mathematics that will assist our graduates in understanding the diversity of issues and perspectives that will confront them in adulthood, and to develop within them mastery of a set of skills that are necessary for critical engagement with culture and society. Among these skills are the understanding and interpretation of arguments, communication in written and spoken form, the development of aesthetic sensibility, and an ability to deal constructively with ambiguity.

"The number of issues and perspectives that responsible adults are confronted with is vast --- so vast that it would be foolish to believe we could provide a satisfying exposure to all of them to all of our students. We do assume, however, that we can excite students to expand their intellectual horizons, starting at MIT, and that requiring all students to have some exposure to a variety of intellectual traditions, even if not comprehensive, is a good start.

"We also assume that reading complicated texts, writing, and confronting arguments is a set of intellectual practices that is core to all subjects within the humanities, arts, and social sciences, and that students should steadily engage in these practices throughout their four years at MIT. While we reject a strict "pace requirement" for the HASS requirement, an 8-subject HASS requirement is a reasonable method by which this steady engagement can be fostered.

"We assume that any HASS requirement we construct must take into account MIT's distinct culture and the distinct educational challenges that face achieving the goals of the HASS requirement. In designing a HASS requirement and a distinct freshman HASS experience, we are not constructing a Platonic ideal liberal arts curriculum.

"The particular challenges we face in constructing the requirement are these:

- We would like for the intellectual imprint of the HASS curriculum to be felt outside the classroom at MIT. We believe that to do so requires amassing enough students who are exposed to the same experience such that spontaneous conversations about the material will naturally erupt in places like the living groups.
- We would like for students to understand that the Institute greatly values the study of the humanities, arts, and social sciences and that the Institute believes that attention to these subjects is critical to one's success later in life. A major, well-supported effort of the sort imagined by the "faceted freshman core" would demonstrate this seriousness.
- The intellectual culture settles in early at MIT. If the attention of students is not grabbed in the freshman year, it won't be grabbed.
- Requirements are approached, by the students and faculty, as hurdles to be jumped and, eventually, as games to be played, rather than as the academic guides they are meant to be. The multiplication of requirements proliferates game-playing and devalues the underlying academic purposes of the requirements."

Excerpts from the Draft Report of the Task Force Subcommittee on Optimizing the Science and Engineering Components of the GIRs

"The Science-Engineering Subcommittee of the Task Force reaffirms the long-held belief of MIT's faculty that all of our students need a strong background in mathematics and the basic sciences as preparation for their majors and, more importantly, as preparation for their future roles in society. This foundation includes exposure to the basic principles that underlie new discoveries in science and engineering. In addition, it includes an introduction to the modes of quantitative analysis that lie at the heart of science and engineering…. The Subcommittee feels strongly that a balanced and well-integrated Science and Engineering Core and a mandatory project-based experience would substantially improve MIT undergraduate education….

"All Subcommittee members feel that each student should have a **project-based experience**, focused on the creative process, prior to graduation. Moreover, in the opinion of almost all Subcommittee members, the current six-subject Science Core is insufficient general preparation for our students. Those members who feel this way advocate an increase in the number of quantitative subjects that comprise the Science Core, although some of these might belong to a set of restricted electives rather than be explicit requirements….

"….Increasingly, we see that our graduates are bridging gaps between traditional disciplines in their careers after MIT. In addition to the deep, specialized training that is the hallmark of an MIT education, we should prepare our students to take leadership roles in driving innovations in science and engineering, especially the design of new hybrid disciplines. Such roles require both a strong foundation in current knowledge and the creative capacity to develop new knowledge.

"…Scientists and engineers view the universe around us and approach problems differently from other people. Confident in the value of these perspectives for ensuring the future of our society, and cognizant of MIT's special responsibility to train the next-generation of leaders in science and engineering, our Subcommittee feels that all of our graduates must be exposed to the essential methods of science. Most Subcommittee members feel that an exposure to the essential concepts of engineering and technology is equally important, but a few do not. The problem with designing a small number of requirements to provide such essential background is that there is no single "scientific method", nor is there a single "engineering method"…

"In the majority opinion of our Subcommittee, the current Science Core falls short of the mark in providing a comprehensive coverage of the fundamental concepts and methods of modern science and engineering. Most of us felt that computation, as well as probability and statistics, should be mandatory – or at least strongly recommended – components of the MIT educational experience. Mathematics beyond the Calculus of Multiple Variables – for example, ordinary differential equations and linear algebra – prove to be of great importance for most of our students already, and few of the rest would not benefit from additional mathematics. Most Subcommittee members felt that

our students should develop at least a rudimentary understanding of how complex systems behave. They might do so by taking, for example, subjects on complex natural systems (e.g., the Earth system or the human brain) or engineering systems. An expanded Science and Engineering Core would include each of these – and a narrow range of other subjects as well – as either requirements or part of a group of electives, depending on how the new Core was implemented. Rather than suggest a specific set of additions to the current Science Core, we struggled with the challenge of identifying the essential qualities of appropriate subjects. All of us feel that such subjects should expose fundamental modes of inquiry in a way that clearly distinguishes the value of different mathematical, science, and engineering perspectives on problems. Collectively, the subjects of the Science and Engineering Core should provide the broad background necessary to frame and move toward the solution of quantitative problems, and to employ the methods of science and engineering to improve society,

"We propose that the Laboratory Requirement be eliminated and replaced with a Project Requirement. The members of the Subcommittee were, however, divided on the issue of whether or not this requirement should be aimed at first-year or first- and second-year students – following the spirit of the original Laboratory Requirement – or should simply be a graduation requirement."

Excerpts from the Draft Report of the Task Force Subcommittee on Balancing the Majors and the GIRs

[The full text of the draft report includes recommendations in the following areas:]
1) Encourage interdisciplinary education through new degree structures
2) Introduce a freshman design/project experience
3) Endorse and promote international educational experiences
4) Provide a focused introduction for freshmen to the educational goals of an MIT education
5) Provide better academic and career advising
6) Require departmental programs to examine how science/engineering impacts society
7) Re-consider the role of advanced placement credit for science core subjects

• "Encourage interdisciplinary education through new degree structures

"The Task Force believes that students should embrace interdisciplinary thinking, as this is a driver for innovation. Students should be exposed, in a meaningful way (i.e. not just one random course), to more than one major discipline during their MIT education…. **[**thus, one suggestion from the subcommittee is to] create a *Double Major*. The Double Major would entail the completion of all degree requirements for two different majors, but would not require an additional 90-unit for the second major.….

"The subcommittee also recommends that all departments be encouraged (or required) to provide an alternative degree tracks that allow for greater breadth and flexibility….

" In addition, the idea of a *Dual* or *Combined* degree was considered. This degree would combine reduced versions of two different majors in a way that emphasizes the connections between the two disciplines….Because these projects could be highly individualized, they carry a high faculty-time-cost per student. To offset this, MIT should provide incentives for pairs of departments to develop and support combined degree programs…. "

• "Endorse and Promote International Educational Experiences

The Task Force has endorsed the idea that an MIT education should enable students to assume leadership roles in a global society. To achieve this, MIT should promote exposure to other countries and cultures of the world. Further, experience has also shown that taking time away from MIT's structured pedagogy (emphasizing deadlines and problem sets) has a positive influence on student learning and maturity.

MIT should set up a central office to coordinate and expand the opportunities for students to study or intern abroad (or at sea). Successful existing programs include the Cambridge-MIT Exchange, and foreign internships through MISTI. In addition, all departments should be required to state their policy regarding study abroad in print, *e.g.* in the course bulletin…."