The MIT Faculty Newsletter

OpenCourseWare

Fire Hoses and Water Sprinklers

Gayle C. Willman

If getting an education at MIT is like taking a sip of water from a fire hose, perhaps MIT's OpenCourseWare (OCW) concept can be compared to a lawn sprinkler – at its finest, as thought-provoking as Feynman's lawn sprinkler (see <http://www.varatek.com/scott/feynman_problems.html>).

OpenCourseWare will make MIT course materials available on the Web, free of charge, to any user anywhere in the world. Syllabi, lecture notes, course outlines, reading lists, and assignments for each course, as well as other types of content will be provided.

Described by Faculty Chair Professor Steven R. Lerman as, "...a model for what a top-flight institution constructs for its education programs...." OpenCourseWare has inspired applause, debate, and a good deal of discussion. The intent of this article is to present a variety of perspectives. Faculty comments are encouraged, and will be published in a future issue of the *Faculty Newsletter*.

At present, MIT is undertaking a number of ambitious projects with the potential to significantly impact education through the use of new technologies. In this context, a campus study group was charged with devising a project that reached *beyond* MIT campus classrooms. Composed of faculty, staff, and consultants, the group was chartered by MIT's Council on Educational Technology. The OpenCourseWare concept is the result.

The OpenCourseWare project will begin as a large-scale pilot program over the next two years, and will include the design of the software and services needed to support such a large endeavor. Protocols will be devised to monitor and assess OCW's utilization by faculty and students at MIT, and throughout the world. By the end of the two-year period, materials for more than 500 courses are planned to be available on the MIT OpenCourseWare site.

Although it has been reported that most of the MIT's faculty members support the plan, some do have reservations.

Graves New Faculty Chair

Newsletter Staff

The new chair of the faculty for a two-year term beginning June 15, is Stephen C. Graves, the Abraham J. Siegel Professor of Management Science and Engineering Systems.

A local boy, Graves was born and raised in Pittsfield, MA, where he spent many hours dreaming about patrolling center field for the world champion Yankees. Upon the realization that this would remain a fantasy, he left his home town to attend Dartmouth College to study math and eventually earn an A. B. Not knowing what else to do, he stayed at Dartmouth for an M.B.A., which was very useful; Graves now at least knew what he did not want to do, namely go to work for a living.

With his Dartmouth degrees in hand, Graves then ventured far from home, all the way to the University of Rochester, where he studied for three years to earn his Ph.D. in operations research. Having seen enough of the rest of the world, Graves returned to New England and

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From The Faculty Chair

Reflections

Steven R. Lerman

In June, the position of Chair of the MIT Faculty will pass into the extraordinarily capable hands of Steve Graves. We as a Faculty are lucky that he has accepted this position. As the outgoing Chair, I wish him all the best.

As the end of my term as Chair of the Faculty approaches, I have spent some time reflecting on the general state of MIT. One of the best things about being the Chair is the opportunity to see how the place works, and how the various competing forces influence decisions. Being the Chair of the Faculty allows a wonderful view of how MIT's broad mission gets translated into day-to-day decisions, and how the distinct priorities of the departments, schools, laboratories, research centers, and administrative offices are reflected in the tradeoffs made both implicitly and explicitly. One is an insider because of the nature of the Chair's responsibilities and access to the senior administration, and an outsider in the sense of participating in decision-making but not having any line responsibilities. This odd combination of aspects of the job of Chair of the Faculty allows an almost unique perspective on the university. My wise predecessors tried to explain this to me, but the truth is that it is one of those things that is best understood retrospectively.

The experience of being Chair has led me to several conclusions about the university, its administration, its faculty, its staff, and its students. Perhaps the most significant is that, in many ways, MIT is in the best shape it has been in for the 25 years that I have been on the faculty. We have recovered from the painful legacies of the period of federal cutbacks in research funding, internal budget cuts, and the changes induced by Reengineering. The enormous successes in fund raising in the later part of the 1990s, accompanied by the growth in the endowment resulting from successful investment strategies, have allowed an almost unprecedented, and long overdue, rehabilitation of the physical plant. We have seen a growth in undergraduate applications that has permitted us to be even more selective than ever before,

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and we have been able to increase financial support for graduate and undergraduate students. We continue to attract many of the world's most talented individuals to our faculty and student body. We have been able to support new initiatives in many areas of teaching and research. The faculty, staff, and administration for the most part function in a collegial and collaborative way that avoids the worst of academic politics. In short, the reputation of MIT as a one of the world's premiere universities seems as secure as ever.

The Institute continues to face a wide range of challenges. Running a premiere university is more complex and expensive than ever, particularly one such as MIT with a large portion of its faculty in areas of engineering, science, and management. Research in these areas often requires enormous investments of money and space, and we compete for

the best people in the world with other top universities, some of which have financial resources considerably greater than our own. The decisions we face are often complex, requiring large investments in people and research funds in the face of great uncertainty about the outcomes.

This difficult environment produces pressure to undertake programs and projects that have short run payoffs. My own observation is that we tend to make the best decisions when we pay less attention to the short term and instead are guided by a broader and longer-range view of our mission. I'll explore some examples of this below.

Great universities have historically provided their faculty and students with tremendous autonomy, job security and flexibility, allowing us to do our research and teaching with a maximum of support and a minimum of interference. There is an implicit contract in which, in return for this support and flexibility, we devote our energies and efforts to educating our students and advancing human knowledge to the best of our abilities. As unlikely as it might seem on the face of it, this implicit agreement has worked incredibly well. Nevertheless, there is often a temptation to focus the faculty's

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efforts in a more coordinated way, picking just a few research areas that seem most productive and directing the efforts of the faculty towards those areas.

Such a narrowing would be a terrible mistake. First, it is unlikely that we would pick the right areas. Even if we did, a very narrow focus on research areas selected by others would make this a singularly unattractive place to work. Many of the best of us would leave, either for better-paying positions or for places that gave us more flexibility. The good news is that this is well understood by the administration, and no one in it thinks otherwise.

Another example is need-blind admissions and need-based financial aid for undergraduates. In the short run, there is great temptation to use financial aid as an incentive to attract students who either can pay a larger fraction of the total cost of an MIT education or who, by whatever metrics, appear to be the most talented. Many universities have already taken these steps. In addition, some of our peers who claim to operate need-blind admissions and need-based financial aid have eroded these principles at the edges. Combinations of athletic scholarships, special merit-based scholar-ship programs, legacy admissions, and distorted calculations of financial need all have been used to undermine admissions policies at many universities.

MIT has always tried to admit the finest undergradute students we can attract and provided everyone with the aid they need. These policies reflect our core values as an institution, and we abandon them at our peril. MIT's exemplary decision to oppose the federal government's efforts to prohibit coordination of financial aid policies among the top universities was symbolic of our commitment to these values. Despite its lack of pragmatic benefit, our success in the subsequent litigation was one of our greatest moments. As the circle of universities remaining true to the spirit of need-blind admissions and need-based financial aid gets smaller, we as a faculty must continue to maintain these policies even at considerable cost to the university. I have no doubt that our administration will continue to support such efforts. Moreover, our alumni will continue their historic generosity as long as we sustain our commitment to the ideal of a university that is accessible to the best students regardless of their financial means.

Still another example is our commitment to achieving diversity in

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our students, staff, and faculty. Every university articulates the need for such diversity, but few would undertake the broad review of gender equity that was reflected in the recent report on the problems facing women faculty in science. Doing such a study, taking corrective actions and distributing the conclusions, is something no other university has had the courage or commitment to do. Through this process we learned things that we wish weren't true, and we unquestionably have much more work to do in the future before the opportunities that MIT provides are equally accessible to all groups in society. Nevertheless, the way we as an institution addressed this issue reflects what makes MIT special, and we should not hesitate to tackle other difficult problems in a similar way. In that spirit, President Vest and I have jointly chartered a Task Force on Minority Student Achievement that is addressing other, complex issues with a similar directness.

Having reviewed some of the great strengths of MIT, it is also worth noting at least one of our ongoing, and largely unresolved, problems. As I have noted in earlier columns, almost every faculty member I speak with reports feeling stretched across too many obligations. No one thing stands out as taking too much time; rather it is the sum of small time demands that collectively taxes us and divides our time into ever smaller increments. In a metaphorical sense, our available time is being "nibbled to death by ducks."

Many of the things we most want, such as increased interactions with our students and a greater sense of an MIT-wide community that involves us in the non-academic lives of our students, simply cannot be accomplished without freeing up more time in our crowded schedules. The growing demands for faculty members' time and attention also threaten our ability to think deeply about our research and teaching. At the extreme, they have the potential to slowly undermine almost everything that has made the Institute great.

It is one of my few regrets that we haven't made real progress on this issue, so as outgoing Chair, I humbly bequeath it, along with a batch of other, still pending problems, to Steve Graves. May you also find being Chair as fascinating and rewarding as I have.✤

[Steven R. Lerman can be reached at lerman@mit.edu]

A Letter to Faculty

April 11, 2001

Dear Colleagues:

These are wonderful times for educational innovation at MIT. With support from sources such as the d'Arbeloff gift, Project iCampus, Alumni class funds, and funds given directly to departments and Schools, many of us are developing new educational programs. The faculty committees are eager to support these activities in every way possible. The Committee on the Undergraduate Program (CUP), in particular, is charged with licensing, supervising, and assessing educational experiments, and can grant exemptions from Institute requirements to facilitate the introduction of new teaching styles and methods.

As the Chairs of the Faculty committees responsible for oversight of educational programs, we are finding that some new educational initiatives conflict with long-standing MIT practice. We are especially concerned that online delivery of subject material and asynchronous discussion is being substituted for face-to-face contact between faculty and students and among students in a cohort. Since some of the new initiatives address the shortcomings of conventional lectures, there may be much to gain by replacing some lectures in some subjects with carefully-planned alternatives. However, the recent *Task Force on Student Life and Learning* report emphasized the central importance of personal contact throughout a student's years at MIT. We endorse this finding and intend to be particularly careful when proposed subject changes would reduce actual contact time between faculty and students.

As a rule the Committee on Curricula (CoC) must approve a new undergraduate subject or significant changes in an existing one before it can appear in the *MIT Bulletin*. We believe that plans to substitute online delivery of subject material for conventional lectures represent a significant enough departure from current practice to require informing the CoC. [When a subject is approved by the Committee on Curricula (CoC), it is approved for a specific time distribution that denotes the expected number of weekly hours for lectures and recitation; laboratory, design or fieldwork; and preparation (e.g., 3-0-9). We generally interpret the first and second digits in the unit distribution as the number of weekly hours of face-to-face contact among students or between students and faculty.] In general, we believe the net effect should not be to reduce face-to-face contact. Instead, we hope that when traditional lectures or recitations are replaced by online delivery of the same material, they will be augmented by tutorials, seminars, informal discussion, design, or problem solving sections, or other unconventional educational modes.

Changes to existing subjects that would lead to an actual decrease in face-to-face contact between faculty and students will need to be presented to the CUP. Such proposals could go forward as CUP licensed educational experiments to permit time for assessment and evaluation.

We hope to hear of more new and exciting ways to use distance learning technologies to enhance the educational experience of our undergraduates.

We would be pleased to hear from you.

Robert L. Jaffe
Chair, Committee on the Undergraduate Program

Ahmed F. Ghoniem
Chair, Committee on Curricula

Steven R. Lerman
Chair of the Faculty

TEACH TALK

The Contribution of Constructivism
Lori Breslow

This is the second of three articles reporting on the latest developments in the research on learning. The first described work on the differences between expert and novice problem solvers. This second article will look at a theory of learning called "constructivism," and its implication for teaching strategies. Unless otherwise noted, information for this Teach Talk *comes from "Meaningful Learning in Science: The Human Constructivist Perspective" (hereafter referred to as "Meaningful Learning") by Joseph Novak, Joel Mintzes, and James H. Wandersee. It appears as a chapter in* Handbook of Academic Learning*, Gary D. Phye, ed., Burlington, MA: Academic Press, Inc., 1977.*

Albert Shanker, who for many years was president of the 940,000-member American Federation of Teachers, is reputed to have had a sign in his office that read, "I taught but the students didn't learn. Define 'taught' in that sentence."

That sign came to mind as I began to work on this *Teach Talk*. It is a gripe that runs the gamut from elementary school to college classrooms: Although the instructor did his/her best to teach the material, the students just didn't learn it. This refrain rears its head at MIT when faculty teaching sophomores complain they need to cover material supposedly taught in the freshman year. And it is heard when faculty teaching upper level subjects wonder what went on in sophomore courses because students don't know the fundamentals of the field.

Of course, the natural tendency is to blame someone for this problem, and more often than not, it is the students

who take the brunt of the attack. But if you listen closely, there are also subtle implications that faculty may be doing something wrong as well (trying to cover too much content or not enough; emphasizing theory over application or vice versa). I believe, however, it is entirely possible everyone is doing his/her best in the classroom even though the results are disappointing. It is possible the students aren't slacking off, but working hard, and that faculty members are putting hours of preparation time into lectures, recitations, problem sets, and exams. Yet *still* the students aren't learning – or aren't retaining – the subject matter. The problem is, like any other skill, success in teaching can only go so far if it is not informed by knowledge of the theoretical underpinnings of the endeavor, a familiarity with best practices, and a willingness to use both.

Work in the learning sciences, fed, in part, by cognitive psychology, has reached a state of development so that it can tell us something about how to channel our efforts in teaching for best results. The *human constructivist* perspective – so-called because its fundamental assumption is that learners construct their own knowledge – is perhaps the most fruitful of this work. It is an attempt to unite the psychology of human learning with the epistemology of knowledge production ("Meaningful Learning," p. 418). At its core is the idea that for humans, learning is a process of "meaning making," which entails the acquisition of concepts [the author's define concepts as "the basic units of meaning, as perceived regularities in objects or events that are designated by a sign or symbol" ("Meaningful

Learning," p. 419)], the modification of concepts, and an understanding of the relationships between concepts ("Meaningful Learning," p. 418). For students in the sciences and engineering, a central task of education is to "make meaning" about the natural world and how to modify it productively.

Meaningful Learning

The human constructivist perspective, which began as early as the 1950s, sprung from the work of developmental psychologists, particularly David Ausubel. Ausubel theorized that as the learner forged links between old and new knowledge, and committed that new structure into long-term memory, he/she was engaging in meaningful learning. Cognitive science has recognized that learners "see" patterns in objects and events based on prior knowledge; that "what you see depends on what you know (and vice versa)." ("Meaningful Learning, p. 420). This idea, which is commonplace in both epistemology and the philosophy of science, led Ausubel to formulate one of his most important ideas about teaching. "The most important single factor influencing learning is what the learner already knows," he wrote in *Educational Psychology: A Cognitive View*. "Ascertain this and teach him [sic] accordingly." ("Meaningful Learning," p. 406).

So began a profound shift in the educational community's understanding of how learning occurred. Prior to Ausubel's insight, it was assumed learning was a one-way process from teacher to learner. Ausubel inspired educational theorists to conceptualize learning as an *interactional* process in

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which the learner's prior knowledge played a crucial role. Rather than being a blank slate, the student enters the classroom with notions about the physical world that come from a variety of sources, including personal experience, direct observation, sensory awareness, peers, the mass media, and previous instruction. The problem is sometimes those ideas are incomplete, inconsistent with accepted scientific knowledge, and/or downright wrong. "At last count," write Mintzes, Wandersee, and Novak, "just under 3500 studies [over 25 years] had addressed issues related to students' alternative conceptions in science." ("Meaningful Learning," p. 408).

Research has further revealed that students' age, gender, ability, or ethnicity has no effect on whether or not students hold misconceptions. More importantly, this research has also shown that once taking hold *"these ideas are often tenacious and resistant to extinction by conventional teaching strategies."* ("Meaningful Learning," p. 410). For example, Diana Laurillard, in her book *Rethinking University Teaching,* describes investigations undertaken to reveal misconceptions about Newton's Third Law. Freshman physics students were asked to apply the Third Law by describing the forces on a box resting on a table. Many of the students' explanations reveal their misunderstanding or misapplications of the law. According to Laurillard, the causes of this problem include everything from the "everyday experience of force," which override an abstract principle one only reads about, to mistakes in the way textbooks present Newton's formulation. This latter problem Laurillard calls "pedagogic error," which, she writes, is "comparable to iatrogenic disease." (p. 42).

Difficulties in learning the central tenets of science, constructivism holds, derive from students' inability to construct meaning about the phenomena and relationships science seeks to illuminate. This can be caused by the fact that, as discussed above, the learner's prior knowledge is faulty. Another reason may be that the student or instructor may not be committed to the student engaging with the material in any kind of substantial way. (For a discussion of the instructor's role in discouraging "deep learning," see "When Students Learn," *Teach Talk,* October/November 1996, w e b . m i t . e d u / t l l / p u b l i s h e d / teach_talk.htm). In that case, "new knowledge is incorporated in an arbitrary, verbatim fashion," which Ausubel called *rote learning* ("Meaningful Learning," p. 420). Although the physiological process of incorporating concepts into long-term memory is not completely understood, there is some evidence that the duration and use of knowledge stored in long-term memory depends on the structure of that knowledge. Thus, students who merely memorize– without the linking that accompanies meaningful learning – are more likely to lose that knowledge. This would account for the fact that students often report they have never seen some subject matter even though faculty know they presented it in class.

Researchers in the field also have begun to uncover the learning strategies used by students who do master the scientific disciplines successfully. They have begun to understand the underlying conceptual work that students need to do in order to learn meaningfully. "The most comprehensive claim," Mintzes, Wandersee, and Novak write, "is that *successful science learners develop elaborate, strongly hierarchial, well-differentiated, and highly integrated frameworks of related concepts as they construct meaning."* (Ausubel et al., *Educational Psychology: A Cognitive View,* 1978, as cited in "Meaningful Learning," p. 414). At the heart of scientific learning, these researchers maintain, is the ability to understand the relationships between higher and lower levels of abstraction, how concepts are alike or different from one another, how one concept can be replaced by or substituted for another. Frameworks can be built gradually with refinements made along the way (a process called "weak restructuring"), or they can be altered radically to accommodate new superordinate concepts ("strong" or "radical" restructuring) ("Meaningful Learning," p. 415). The authors report that science students who achieve a high level of proficiency will use both weak and strong restructuring, with strong restructuring more common in the early phase of learning, and weak restructuring more prevalent as the class goes on. In other words, students must navigate major conceptual hurdles as they are becoming familiar with a topic or a course, but once they have done so, then they can begin to "tweak" their understanding of how ideas fit together. The question this brings us to, then, is what can be done in the classroom to nurture this kind of successful learning.

Instructional Strategies
and Techniques

Mintzes, Wandersee, and Novak hold that in order to learn meaningfully, students need to focus specifically on concepts, the patterns they make, and the relationships among them. They and their colleagues have developed a set of what they call meta-cognitive tools that can be used for this purpose. These techniques have been designed specifically to help students learn how to learn.

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The basic tool in their arsenal is the concept map. A concept map is a diagram of a particular domain of knowledge that places the concepts and constructs (constructs are higher order concepts) that form that domain on branches arranged in a hierarchy. Lines that link concepts are labeled so as to explain the relationship between the two entities (see example below). Advocates of
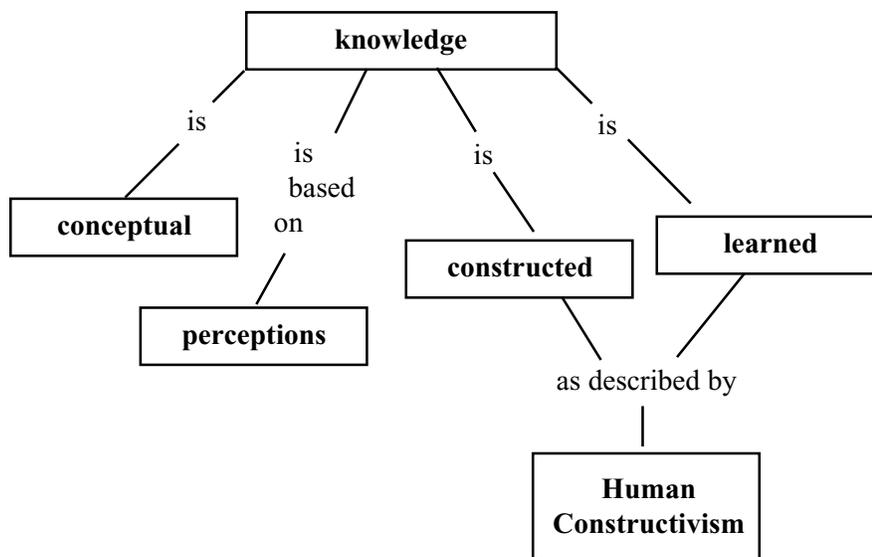
in other words, they help students comprehend how scientists have come to know what they know. Invented by D. B. Gowin, a Cornell University philosopher, vee diagrams are, in some ways, a rough reconstruction of the development of a particular field or idea (see next page). Vee diagrams can be used to help students understand how knowledge is generated in the laboratory

The first three levels of a conceptual map for Human Constructivism
("Meaningful Learning," p. 418)

concept mapping suggest they can be used both as a learning tool for students and as an aid to assessment for instructors. Similarly, concept maps can also be used to brainstorm complex projects by giving the student (or students in the case of a team project) a guide to how ideas and/or tasks will link together to produce required deliverables. Concept webs and concept circles diagrams are variations on the concept map.

Vee diagrams help "students see how science makes knowledge and value claims" ("Meaningful Learning," p. 432);

or how to critically analyze a research report.

Research on the effectiveness of both concept mapping and vee diagrams is encouraging. Studies have found students who use these tools "understand relationships between theory and method, ideas and observations . . ."; score higher in exams that include novel problem-solving activities; and have "positive attitudes toward the subject they study . . . ." ("Meaningful Learning," p. 435).

It may be, however, that the demands of the curriculum in most MIT subjects

will not allow for the time required in class to have students make concept maps, vee diagrams, or the like. But what instructors must make time for, is to explicitly explain the links and relationships among the ideas in the material they are presenting and to address the common misconceptions which students hold.

One Simple Tactic: Address
Common Misconceptions

This last point is worth emphasizing. Much instructional time could be saved – not to mention confusion avoided – if instructors thought about the ways in which their students are likely to misunderstand or misconstrue the concepts with which they are presented. Laurillard cites research on teaching subtraction in elementary school that uncovered 89 ways the students were doing subtraction incorrectly. "But," she writes, "by going to a different level of description, at the level of understanding, [two other researchers] found just two ways of misconceptualising subtraction" (*Rethinking University Teaching*, p. 37). Although the example comes from the K-12 realm, the lesson derived from it is applicable in higher education as well. "If a student borrows across zero incorrectly," Laurillard continues, "we want to teach him not 'how to borrow across zero,' but what 'borrowing' means." (*Rethinking University Teaching,* p. 37). The 89 ways of doing subtraction incorrectly are examples of what Laurillard calls "buggy algorithms" (i.e., flawed procedures); the importance of buggy algorithms is that they reveal fundamental problems with the way in which students are thinking about the underlying concepts. The interesting finding from both Laurillard's freshman physics experiment and the subtraction study is that if the

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Conceptual/Theoretical
(Thinking)

Focus Questions: Questions that focus the inquiry about events and/or objects, or describe the value of the inquiry.

Methodological
(Doing)

World View: The general belief and knowledge systems guiding the inquiry.

Philosophy/Epistemology: The beliefs about the nature of knowledge and knowing guiding the inquiry.

Value Claims: Statements based on knowledge claims that declare the worth or value of the inquiry.

Theory: The general principles guiding the inquiry that explain why events or objects exhibit what is observed.

Knowledge Claims: Statements that answer focus question(s) and are reasonable interpretations of the records or data obtained.

Principles: Statements of relationships between concepts that explain how events or objects can be expected to appear of behave.

Transformations: Tables, graphs, statistics, concepts maps, or other forms of organization of data recorded.

Constructs: Ideas showing specific relationships between concepts, without direct origin in events or objects.

Records: Observations made and recorded from the events or objects studied.

Concepts: Perceived regularity in events or objects (or records of events or objects) designated by a label.

Events and/or Objects: Description of the event(s) or object(s) studied in order to answer the focus questions.

Gowin's vee diagram
("Meaningful Learning", p. 433).

instructor looks further than the superficial mistakes, he/she is likely to find a relatively small number of conceptual misunderstandings at the base of those errors. And because these conceptual problems are relatively small in number, addressing them in class is not only entirely possible, but an efficient use of time. As Laurillard writes, "If you remediate one of the 89 wrong procedures, you have another 88 to contend with; but if you remediate one of the misconceptions, you avoid all the inherited bugs and faculty procedures as well." (*Rethinking University Teaching,* p. 38).

To come full circle, a commitment to addressing and fixing misconceptions is a recognition of the power of conceptual thinking in learning. The ideas associated with human constructivism gives us a way to think about what Laurillard calls the "conceptual apparatus," and it gives us tools to both help students think conceptually and for us to gain insight into our students' understanding of the material we ask them to learn. It is both a theory of human learning and a set of strategies to use in the classroom that are likely to help us teach more easily and more productively.❖

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Undergraduate Education at MIT

Robert P. Redwine

When the editors of the *Faculty Newsletter* asked me if I wanted to write an article for the *Newsletter* as my first year as Dean for Undergraduate Education was nearing its end, I was first of all struck by the fact that indeed a year has passed since I agreed to take on this responsibility, and almost a year has passed since I started the job officially. So much has happened in my own education during that time, but of course it also seems to have passed so quickly!

Being Dean for Undergraduate Education at MIT would be a wonderful opportunity in any circumstance, but when I was considering the possibility last year it seemed to me that the next few years would be an especially important and exciting time in undergraduate education at this institution. With the guidance of the 1998 Report of the Task Force on Student Life and Learning and with important new resources (such as the d'Arbeloff Fund for Educational Innovation) to help make possible many of the changes described by the Task Force, we were already launched on an effort that many of us believe will allow us to offer an even better overall educational experience for our students. The Task Force report is the result of the hard work of a number of people around the Institute, but I believe it also represents a strong consensus in our community that we really do need to do a better job of improving and integrating student life and learning and of using new financial, technical, and human resources to accomplish these goals. It is this strong consensus that I sensed last year and which I believe has grown stronger as we see real progress in reaching the goals. There is every indication that the Task Force report will not suffer the same fate that some other insightful reports over the years have suffered, that of being relegated effectively to the shelf.

I had the major advantage in beginning this job that we were already heading in the right direction. Under the leadership of Roz Williams, previous dean of Students and Undergraduate Education, and of several key faculty committees, many important changes were already underway. With the split of Roz's office into separate but coordinated Dean for Undergraduate Education and Dean for Student Life offices, the new dean for Student Life, Larry Benedict, and I could concentrate on making the administrative aspects of our offices run as smoothly as possible while working together on new initiatives in student life and learning. Larry and I have certainly been kept busy (!), but we have also enjoyed working together and with many others around the Institute on some of these exciting projects. The support of the top administration at MIT for our efforts has been clear and unequivocal. Such support will in the end be critical to our success in reaching important goals.

As I indicated above, important initiatives in undergraduate education are already underway, some as Institute-wide efforts and some Department specific. These include implementation of the new Communications Requirement, which will go into effect with the Class of 2005; preparation for the changes in P/NR and the new exploratory subject option, which were voted in by the faculty in April and which are expected to go into effect with the Class of 2006; and the variety of exciting experiments and projects which are being made possible by the d'Arbeloff and iCampus funds and by alumni class funds.

These experiments and projects currently run the range from those which promise to change the way we teach introductory science courses, to those which explore project-based learning as an important aspect of an undergraduate education, to exploration of how we may be able to improve our advising and mentoring of undergraduates. Important themes in these experiments include the role of active engagement of the students in the learning process and the importance of serious assessment and evaluation of educational changes. Those of us who have been involved in these initiatives find them very exciting, as they offer real promise for important and far-reaching improvements in the education we offer our students. Another very welcome new development is the opportunity for undergraduate exchanges with Cambridge University, as part of the CMI (Cambridge-MIT Institute) agreement. Next year we expect to have about 30 students each from Cambridge and MIT spending a year at the other institution. This number will likely continue to go up for the next several years as we find ways to reconcile curricular issues at both institutions. Many of us are excited by the prospect that study at Cambridge will be an important part of the undergraduate experience for many of our students.

While at first glance they may not seem directly related to undergraduate education, the recent changes in our student financial aid policies which were approved by the Corporation will in fact have important positive effects in this area. In particular the reduction in the required self-help level will not only keep us competitive in attracting the most qualified students, but will also significantly reduce the academic year pressure for many of our students.

As we all know, MIT can be a bewildering place for anyone who looks for clean organizational charts and clear

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at MIT

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areas of responsibility. The area of undergraduate education is certainly an example! Many people and offices around the Institute have important roles in this area, and we succeed only when we have good communication and shared goals. I have very much enjoyed working with the Schools and Departments, with the faculty officers and committees, and with individual faculty, staff, and students. The Committee on the Undergraduate Program in particular plays a key leadership role in shaping changes in this area. I believe that the Committee has done a wonderful job this year in leading some of the changes referred to previously and in working with my office to shape and implement future initiatives. We really are very fortunate to have the dedication of the faculty and others who serve on these committees.

What more do I see happening in the area of undergraduate education in the next several years, and what do I expect my office to spend resources and time on making happen? This is a question which I am asked in one form or another quite often these days; I suspect it was really the question in the minds of the editors of the *Newsletter* when they asked me to write this contribution. I would present the answer as three not-really-independent aspects:

Project-Based Learning

The experiment led this year by Kip Hodges (Mission 2004) was an extraordinary success, with enthusiastic and engaged students, faculty, and alumni mentors. It confirmed the opinions of many faculty that we would do well to try to include a significant project-based experience in the education of most if not all of our students, especially early in their time at MIT. This experience would be complementary to the introduction to science that we provide to students in their first year at MIT. I expect the next several years will see much experimenting with, and discussion of, this exciting possibility.

Improved Teaching
and Learning Facilities

It is no secret that space is one of the most constraining features of many activities at MIT these days. That includes especially teaching and learning space. In many cases the Registrar's Office, which controls the classroom inventory, has difficulty renovating classrooms simply because it is difficult to take a classroom off line long enough to accomplish the needed renovations. When the Stata Center is complete the situation will improve significantly, but we will still have important needs for more such space, especially flexible space which can be used for studio-based courses, student design projects, etc. I expect to continue to work with many of you to bring about the needed enhancements in our teaching and learning facilities.

Faculty Involvement with Students
Outside the Classroom

Many people over the years have recognized that improvements in student life and learning at MIT would be much easier to achieve if faculty had more time and opportunity to interact with undergraduates outside the traditional classroom. We do a considerable amount of this already, of course, especially in the UROP program. However, most of us have little involvement with the student life side, and our advising system has many flaws, as indicated by a recent student-led survey. Part of the difficulty is just available faculty time, as documented so well in the recent Task Force report. The opportunity for faculty involvement can be made easier by helping faculty to live closer to campus. A step in this direction will be the five faculty apartments in the new Simmons Hall, in addition to the usual Housemaster's apartment; other ways to encourage faculty to live near campus are under consideration by my office and others. It is clear that the incentives for faculty rewards must be consistent with what we expect from our faculty in terms of contributions to teaching, research, and community. I believe we have seen a significant change in the past two decades in the direction of placing more weight on teaching and community service. In any event we must be sure we give a consistent message, especially to our junior faculty colleagues, about our expectations and rewards.

Finally, I want to comment on one aspect of the relationship between faculty and students. One important lesson for me in the past year has been the simultaneous importance and difficulty of involving students in discussions of changes in student life and learning. The importance is clear; there are many examples of critical contributions by students to discussions of important changes. However, we can no more expect any student or group of students to fully represent the views of all students than we can expect a group of faculty to represent the views of all faculty members. While it is sometimes difficult to know the opinions of many of our students, we must have a variety of ways for students to be involved in designing and implementing changes, and we must involve them as early as possible. We will all benefit in the long run.❖

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Suicide

John Hildebidle

I'm sure you noticed how there are sudden outbreaks of what I can only call the "issue de jour." Same sex marriage, teenaged drinking (there's a shocker – college kids drink!), violent crime (and its connection to TV violence), world terrorism: they have all had their moment in the sun, with TV docudramas, newspaper and news magazine features, even feature films, all in rapid succession or even at the very same moment. We like to tell ourselves that MIT is utterly (and, in the end, benignly) unique, but we hardly escape.

Lately, suicide, especially among the young, has had its time on-stage. And there was MIT, with a long two-part feature in the *Boston Globe*, full of (to me) contradictory statistics and heartrending individual tales.

I should lay my cards on the table – I've known two bright, talented Harvard undergraduates (or, to be precise, one sophomore and one fellow who was less than six months past his graduation) who killed themselves, and I don't for a moment pretend to understand it. Nor the death of one of my daughter's most loving and energetic daycare providers. Nor, surely if more distantly, the recent Westgate victim, with whom I did not in fact have any personal contact. Nor do I hear, amidst all the journalism and worrying, much clear advice about what can be done to forestall such horrors. One thing is clear – if recent articles in *Tech Talk* are any evidence, MIT undergraduates are convinced that we as an institution must do something.

But somehow it never quite gets on the agenda. Not too long ago I attended one of those "random" faculty dinners hosted by Jay Keyser, where Jay (as is his custom) threw the floor open over dessert. "What is on your mind?" The answer? Some anomalies in the MIT e-mail system and the operations of I/S, and the new "open course ware" Web initiative. I kept thinking, as I sat there, "Somebody has to bring up the s-word." I thought it was just my own Calvinist conscience; but as I rode home with a group of my colleagues, one of them said, "I kept wanting to bring up suicide." Why did neither of us screw up the courage?

Partly, I think, because all of us at MIT like to think of ourselves as problem-solvers, and so none of us feel very

> I should lay my cards on the table – I've known two bright, talented Harvard undergraduates . . . who killed themselves, and I don't for a moment pretend to understand it. Nor the death of one of my daughter's most loving and energetic daycare providers. Nor, surely if more distantly, the recent Westgate victim, with whom I did not in fact have any personal contact. Nor do I hear, amidst all the journalism and worrying, much clear advice about what can be done to forestall such horrors.

comfortable venturing into terrain where the map is cloudy. It's the same kind of intellectual, even moral, wariness that makes us rather prone to hide out within our own fiefdoms, and avoid venturing into other areas of learning. So why expect us to barge into a major psychic mystery?

And then too, what hope is there of concocting some viable "policy" about suicide on campus? Who would be covered – just currently-enrolled students? Pre-frosh visiting the place? Recent or long-ago graduates, back for another look? Passers-by, or guests (invited? uninvited?)?

A colleague of mine insists we need a "zero tolerance" policy on the matter. But surely we have one, already? Is it a bit too implicit? Do we really think that saying, at some formal gathering of each new freshman class, "Don't kill yourself, while you're here," would have any demonstrable effect?

But we are, all of us, good, *damned* good in fact, at solving intractable problems; so the fact that no resolution presents itself immediately hardly need be a disincentive. I've proposed to the Chair of the Faculty that suicide be put on the agenda of a faculty meeting, and soon; I invite my colleagues to join me in that request. Would not the mere fact that we, as a faculty in solemn conclave gathered, cherish our students enough to confront the self-inflicted death of even a handful of them (the statistics in the recent *Boston Globe* series were confusing and even contradictory as to the relative and absolute frequency of such acts on this campus)?

And, by way of framing the issue, I would offer one empirical observation, based on nearly 20 years on the MIT faculty. Let me approach it by way of an anecdote. At about the time Rodney King was assaulted by the Los Angeles Police Department, I was teaching a course in African-American history. Among the students in the class was a

remarkable young man who, aside from an ability to read carefully, to think deeply, and to articulate his thoughts powerfully and lucidly, had what I can only call *presence.* He was the kind of person to whom, if you were in a crowded dining room and someone shouted "Fire," you would look for guidance about what to do.

He came to me, long after the end of the course (and after he had taken the responsibility for keeping order at the area-wide student demonstrations in support of Mr. King. You may recall that, despite extreme rage on the part of students from all over the greater Boston area, there was not a single instance of disorderly behavior), he came to ask if I would write him a recommendation for law school. I eagerly agreed, and then he went on, "But I'll never get in, of course."

I thought he was indulging in some sardonic joke. But he was deadly serious. Of course, he got into Michigan, Columbia, Chicago, and Harvard Law Schools. But he really believed he would be found unacceptable.

Think back, now – how many seniors have you encountered who really believe that they cannot get into a good graduate school, or find an acceptable job? I will be surprised if there are not a number of instances you can call to mind.

Which ("finally!" I can hear you saying) brings me to my point: *somehow*, and completely without conscious intention, MIT manages to leach away the self-esteem of its students. What is remarkable is that the sense of entitlement and even arrogance which makes them expect the rules to be adjusted to suit their needs remains remarkably intact.

But until and unless we manage to decipher what it is about this place that makes the brightest and most talented late adolescents in the known universe tend to think they are, at a fundamental level, relatively worthless, we will have the unhappy experience of picking up the paper, more often than we'd like, and seeing the headline: "MIT STUDENT VICTIM OF APPARENT SUICIDE."

Not an acceptable state of affairs, at least to me.✤

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Dining with the Brothers

John Hildebidle

Dinner at a frat house? I didn't expect much, least of all when I was told the "entertainment" would involve presentations of "things the Brothers are working on." I imagined lab reports, summaries of problems sets, maybe a quick lesson in Japanese or Russian. The first surprise was that the food was more than palatable – "London broil" that wasn't *Maison Robert* but wasn't *Wendy's*, either. Then we moved into the "living room" for the show.

Out of pure ego I had brought along some of "what I was working on," which happened to be a manuscript of a book of poems. I just hoped it wouldn't put the Brothers to sleep. But imagine my surprise when the members started presenting their wares. First up was a fellow doing quite a creditable job on a scene from *Henry IV, Part I*. He was far too young and far too lean for Falstaff, but as Hal he was about right physically. His "vocal equipment" wasn't Old Vic, but then again he spoke clearly and with feeling. He was followed by a fellow reciting – no text before him, as a prompt, mind you – an extended passage from *On the Road*. Then poetry – Dickinson, some of those surprising, near-Elizabethan love poems of cummings's, and one of Shakespeare's sonnets. The first "original" piece was a song – which to be frank owed a lot to Dylan, but good, gritty Dylan: there are surely worse indebtednesses. Another fellow finally brought us into the cyberworld, by way of a part of a novel all of whose characters are in software at Microsoft. But we recovered, if not sanity, then at least something like it, with zen meditations, and "the wisdom of baseball."

I have, in my time, been in attendance at gatherings of some of Harvard's most self-consciously (not to say self-importantly) "literary" enterprises. But, to my astonishment, this was the equal of those affairs. And the location of the fraternity? MIT, of course. You know all about MIT fraternities, don't you? They drink too much, throw beer cans at police cars, ply underage Wellesley coeds with booze, and just generally model their behavior on *Animal House*. Well, guess what? Not all of them, and not all the time.✤

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Graves New Faculty Chair
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accepted an appointment as assistant professor in the Sloan School of Management in July 1977.

As with many faculty, the early years of his career as a junior faculty member are now just a vague memory. Graves focused on his research, writing papers on arcane topics such as the optimization of warehousing systems, and modeling of production and inventory systems. One highlight during the early years was the 1978 baseball season, during which Graves, a lifelong Yankee fan, was able to observe first hand the suffering of the Red Sox and their fans.

In 1982, Graves took a leave of absence from MIT to live and work in China for seven months. This was a once-in-a-lifetime opportunity to experience China as it was opening its doors to the rest of the world. Graves returned to MIT once he realized that his tenure clock was still ticking, and quickly got back to work. Some time in the mid eighties he was granted tenure, although the records for

this have mysteriously disappeared; presumably he is now grandfathered by some version of the Institute's statute of limitations. In 1988 Graves helped to launch the Leaders for Manufacturing (LFM) program, serving as an acting co-director for the 1990 academic year and as a co-director from 1994 to June 2001. Over the past decade, Steve has taught an optimization class and a supply chain elective for the LFM program; he has also focused most of his research efforts on LFM-related projects, addressing a range of industry-based problems arising in supply chains and manufacturing systems.

Graves has had trouble at times with saying "no" to service and administrative assignments. He served as the deputy dean at Sloan for three years, during which time he helped to redesign the core curriculum for the MBA program. And he has also done tours of duty on a wide range of committees, including the Committee on Academic Performance, the Parking and Transportation Com-

mittee, the Freshman Housing Committee, the Committee on Discipline, the Task Force on ROTC, and the Sloan Dean Search Committee. Steve has generally found these assignments to be quite rewarding, as they provide a way to engage and learn about other parts of the Institute. It has also been a good way to get exercise, given the distance between Sloan and the rest of MIT!

Steve lives in Westwood with his wife, Caroline Marten-Ellis, and two children, ages 9 and 11. Most of his time at home involves shuttling between various kid's activities, and trying to fix things that break around the house. Once summer comes, it's yard work and putting in a vegetable garden, and then waiting for the inevitable collapse by the Red Sox. Steve is deeply honored at being asked to serve as the faculty chair. He looks forward to working with the faculty in all aspects of the faculty governance system. Steve can be reached at sgraves@mit.edu.❖

M.I.T. Numbers

Spring 1999 Survey of Enrolled Undergraduates
(N=1,036)
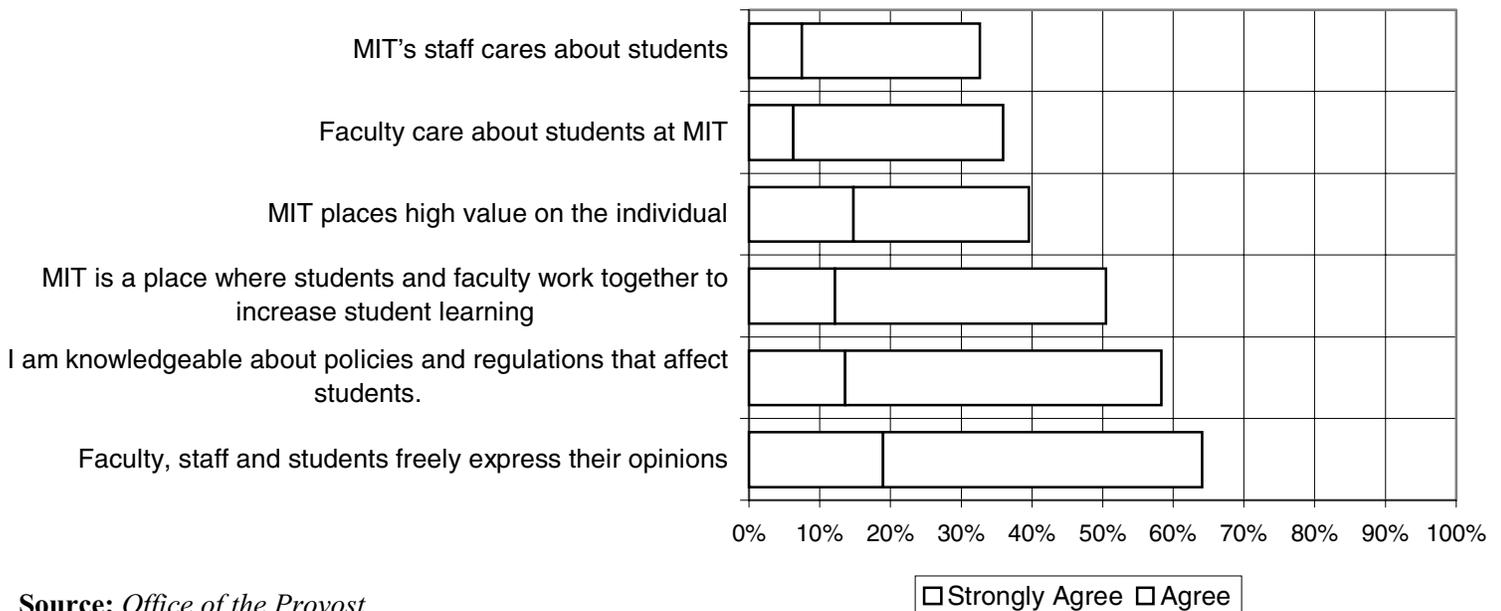
Source: *Office of the Provost*

Fire Hoses and
Water Sprinklers
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Professor of Civil Engineering John Williams expressed concerns about the quality of the Web-based resource and its reflection on MIT. "We're trying to serve too many purposes. There is no chance of stability," he said. "We're going to give away our most valuable asset for what I consider to be a half-baked business plan."

"We came away quite puzzled as to what the OCW would really achieve," said Professor of Architecture William L. Porter. Porter described the Web-based resource as an "elaborate catalog" that could neither accurately represent MIT teaching to the world nor encourage dynamic use of Web-based teaching.

Professor Woodie Flowers, Pappalardo Professor of Mechanical Engineering, posed the question, "If I were to offer you $100 million in venture funds to improve MIT education while making a contribution to world education, and ask only that you have a sustainable operation after 10 years, what would you do?" In a series of futuristic scenarios he illustrated several concerns, among them:

September, 2003

A conversation between two faculty members at a famous university:

Joan: I just tried to find an e-text for my course from the MIT site. I was amazed. That site is a mile wide and an inch deep. When you ask if a particular set of materials will be available next spring, they say, "Sorry, the faculty members make their own decisions about what they e-publish on our site." They don't even support autohomework and shared quiz evaluations. How could I use that stuff? You were there two years ago. What are they doing?. . . .

Al: I have never understood it. . . .There were a bunch of faculty who wanted MIT to focus serious money on e-texts, but they would not spend their own money.

They found a foundation to sponsor a monster project. . . . They actually paid faculty to post stuff, even if it was marginally organized and relevant only to a small group on campus. The faculty teaching commodity courses made deals with outside publishers – businesses that had marketing departments and supported customers. I think they will have to reinvent the whole idea. Not clear, however, whether they will ever catch up with the schools that started with a real strategic plan.

At this stage, the specifics of the plan have not been fully determined and it will still be two years before a pilot system is fully operational.

So, is OpenCourseWare evolutionary, or revolutionary? How does OpenCourseWare differ from MIT course sites that already exist? It may come as a surprise to some that one bit of "inside knowledge," shared on public discussion boards, is the URL path to MIT course materials for anyone who knows a course number. This variation on "open course ware" exists today. Motivated learners are already taking advantage of the materials.

One wrote, "I have been teaching myself computer science for a while now, using the Internet as my source for material. I have usually stuck to different

universities' courseware that just happened to be found by a quick google search. And now this! Hurrah for me!"

Many other questions have been raised, both inside and outside the Institute. Within MIT, a significant one centers on MIT students. How will MIT's students respond?

An MIT student remarked, ". . .you can't even fathom how much work it is for most of these classes and how much most students get out of question/answer sessions in recitation. These are things that cannot be replicated on the Web, and no amount of openly available course material can change that."

President Vest has said from the beginning, ". . .Let me be clear: We are not providing an MIT education on the Web. We are providing our core materials that are the infrastructure that undergirds an MIT education. . . the interactions between faculty and students are the real core of learning. . . ."

Outside MIT, the press was quick to label OCW as a threat to fee-based e-learning courses and content

Eduventures.com, a leading advisor to for-profit e-learning companies, responded, "[MIT's] dissemination of such high caliber educational content is important, but it lacks in value because

> So, is OpenCourseWare evolutionary, or revolutionary? How does OpenCourseWare differ from MIT course sites that already exist? It may come as a surprise to some that one bit of "inside knowledge," shared on public discussion boards, is the URL path to MIT course materials for anyone who knows a course number. This variation on "open course ware" exists today. Motivated learners are already taking advantage of the materials.

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it doesn't incorporate interaction to transform that content into a learning experience. . ." adding, "MIT's move to improve the availability of content isn't a threat to e-learning, but a call to arms to change the nature of elite universities and their control of academic knowledge in the Internet age."

Prospective users of the system, on Internet discussion boards, were vocal. When one critic said, ". . .any idiot can buy a textbook," the remark was was quickly countered by, "…while pursuing my degree I discovered that a good prof was the single greatest factor in the amount of knowledge I gained from a course. . ." and, "You also need a good student body. With an apathetic class, a good Prof can do next to nothing."

"Dissemination of information (and teaching materials) is the real purpose of the Web and the ability to conduct real research through a site such as MIT's will only serve to make things better. Personally I'm extremely excited about the prospects of this. Obviously, not everyone can afford an MIT education (and no amount of reading off the Web could actually sub for an MIT course I'd assume) but it still gives underprivileged and even 'not so highly privileged' individuals the chance to learn outside their normal means. Hopefully other universities will eventually follow suit, because this can only be the beginning. Thank you MIT."

Anticipated outcomes

A number of outcomes have been described. Among the benefits, a positive affect on education. Professor Harold Abelson, the Class of 1922 Professor of Electrical Engineering and Computer Science and MacVicar Teaching Fellow, suggests that OpenCourseWare may facilitate innovations in teaching. "Open-CourseWare stimulates real reflection on what we're doing in the classroom. If my students get all their raw materials on the Web, what am I doing in class? …OpenCourseWare will enable faculty to concentrate on using classroom or lab time to enhance learning," he said.

Another perspective was introduced by Dick K.P. Yue, sssociate dean of the School of Engineering and Professor of Ocean Engineering. He based his vision of OpenCourseWare on his own experience as a boy in Hong Kong who was inspired by an MIT textbook his father gave him. "MIT will miss its goal if it reaches just the students within its walls and not in the larger world," he said.

The possibility of reaching students beyond MIT was expressed by a student at another university, "This project is not about under-mining MIT . . .It's not about giving professors extra workload. It is, however, about a 15-year-old who has above average intelligence getting free access to professional materials that match his ability from anywhere in the world."

Other anticipated benefits include:

• If other universities adopt this model, the vast collection of educational resources will facilitate the exchange of ideas about innovative ways to use those resources in teaching and learning.

• Institutions around the world could make direct use of the OpenCourseWare materials as references and sources for curriculum development.

• Individual learners could draw upon the materials for self-study or supplementary use.

Other anticipated outcomes are voiced as concerns. Is this a good use of MIT professors' time? Will there be consistent quality from one Website to another within the Open-CourseWare system? Can intellectual property issues be resolved?

Putting OCW in Perspective

With over 40 years' experience with educational technology, MIT has had a history of crossing the line between evolutionary and revolutionary at key points in its implementation of new approaches to education.

In the 1960's, MIT engineering faculty members radically altered curricula and authored textbooks to bring computing and modern tools of science and mathematics into the foundations of the engineering curriculum. As engineering graduates joined other faculties, they spread the new approach to engineering education within other institutions.

In the 1990's MIT, in alliance with the two leading research universities in Singapore – the National University of Singapore and Nanyang Technological University – created and implemented a global model for long-distance engineering education and collaborative research. The Singapore-MIT Alliance (SMA) became the first organization in the world to offer advanced degree programs over Internet2. Today, SMA students in Singapore fully participate in live MIT classes, course-related activities, and research collaborations with their counterparts at MIT – though they are physically located 12 time zones away.

To return to the basic question: Will OpenCourseWare be evolutionary or revolutionary? In many important ways, given that their involvement will be voluntary, this question can only be answered by MIT's faculty.✤

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M.I.T. Numbers

Future Uses of Technology in the Classroom

(Reprinted from *The MIT Faculty Newsletter*, Vol. X No. 4, January/February 1998)
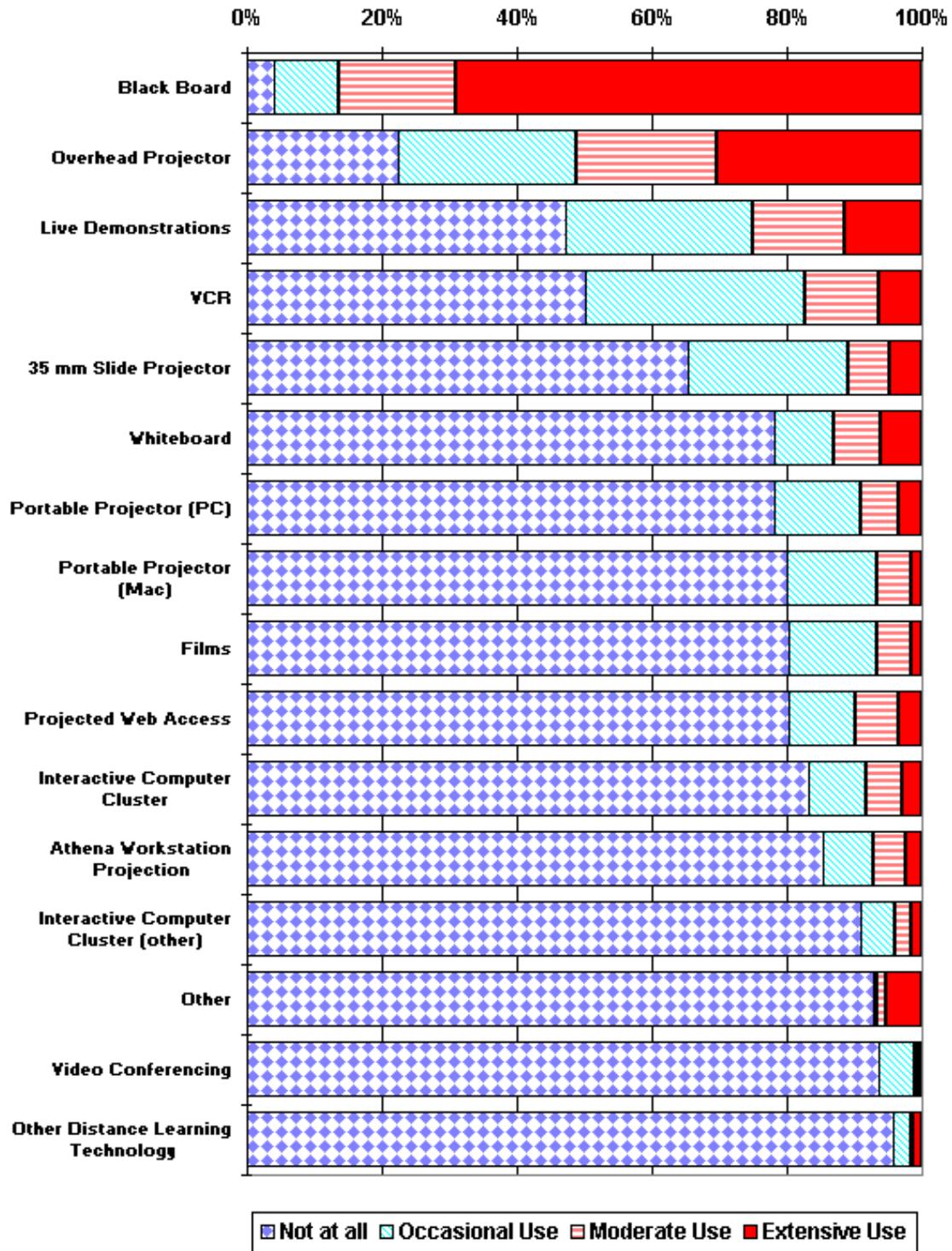
Source: *Faculty Survey by Task Force on Student Life and Learning*

Improving IS @ MIT

James D. Bruce

E arlier this academic year, Information Systems (IS) conducted a customer satisfaction survey. This survey was a key component of current efforts to better assess the needs of our customers in order to sharpen our focus in the future.

Almost 600 people – of whom 14% were faculty, 42% were students, and 44% were administrative/support staff – responded to the survey; a detailed report is available at <http://web.mit.edu/measures/survey/report>. We have reviewed and analyzed the responses, and although there is clear evidence that many of the customers surveyed were satisfied with the service offerings they receive from IS, it is equally clear that faculty are less satisfied with our services.

Faculty Satisfaction Compared to Overall Satisfaction

Rankings were on a scale of 1 (very dissastisfied) to 5 (very satisfied)

Service Area	Overall Mean Satisfaction	Faculty Mean Satisfaction
Desktop Computing	4.13	4.09
Network Services	3.97	3.61
Telephone	3.88	3.73
Network Connections	3.79	3.50
Communications	3.75	3.56
Software Support	3.68	3.34
Training	3.65	3.65
Hardware Support	3.55	3.40
Consulting	3.55	3.30
Help Services	3.54	3.41
Remote Access	3.20	2.80

The areas that we believe to be of most concern to faculty are highlighted below, along with a briefing on the current status of initiatives that we are pursuing to improve performance in these key areas.
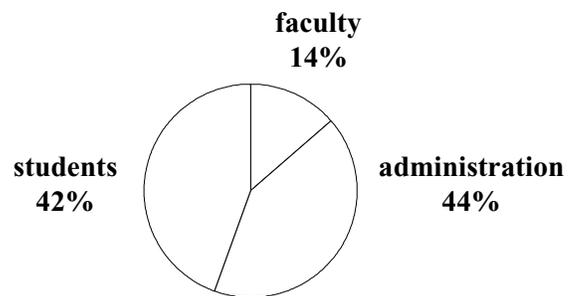
Communication

We recognize that communication between IS and the rest of the MIT community and especially the faculty is critical,

Survey Methodology

During a two-week period in November 2000, Information Systems (IS) addressed a survey to faculty, students, and staff. Two-thirds of the 599 respondents were members of a randomly selected pool of IS customers; one-third responded to a featured link on the Web Spotlight on MIT's homepage. The respondent population consisted of 82 faculty members, 251 students, and 266 administrators.

Given the greater number of responses from the random sample for the administrative community, there is a 95% confidence level in the extrapolation of these results as being representative for that community. There is a 90% confidence level in the results for the faculty and student populations.

Participants in the survey were asked to rank the following 11 IS service areas: Desktop Computing Environment, Network Services, Network Connections, Telephone, Remote Access, Help Services, Software Support, Hardware Support, Consulting and Advice, Communications, and Training.

Respondents rated these service areas according to the following point scale:

1 – Very Dissatisfied
2 – Dissatisfied
3 – Neutral
4 – Satisfied
5 – Very Satisfied
N/A – Responses marked N/A were dropped from the evaluation for each question

Gartner Group, an I/T consulting firm, reports satisfaction levels above 3.45 exceed the average ratings for universities.

Improving IS @ MIT
Bruce, from preceding page

and improving such communication is a top priority. Currently, we are pursuing a three-pronged communication initiative. A project team is exploring ways to allow personalization of IS's Web pages so that faculty and other customers can more easily and more rapidly find what they need (e.g., an answer to a question about whether or not MIT has a site license for software, or Frequently Asked Questions (FAQs) to alleviate waiting for a Help Desk response) when they need it. At the same time, we are looking at new ways to increase the timeliness and relevance of IS communication, and we are putting together a training program to increase the customer service and communication skills of IS staff.

Help Desk/Call Center Responsiveness and Support

It is clear that faculty find the quality and timeliness of Help Desk services to be uneven. Faculty respondents to our survey noted that sending e-mail typically gets better and speedier responses than calling the Help Desk, where responses tend to vary in quality from call to call (or visit to visit), and return contacts can take days or longer. Currently, students working under staff supervision provide most of the staffing for the Help Desk's Call Center. This staffing model is cost-effective and beneficial in that students not only bring technical expertise, but also considerable energy, creativity, and a cultural understanding of MIT to IS's help services. However, this staffing model has obvious limitations that contribute to the uneven quality of service perceived by faculty and other customers. We believe that we must explore a new mix of staff in the Call Center – one that increases the number of professional staff and reduces the number of student staff – to provide better customer service, better problem-solving, fewer handoffs, and higher numbers of promptly answered calls and resolved questions. We have already implemented a Call Center Facilitator role to monitor Help Desk calls and adjust assignments; this has decreased the time spent on hold and increased the percentage of calls answered. We are also exploring expanding our hours of operation to better mirror the work patterns of the MIT community.

Remote Access Service

In survey responses, faculty noted that the Tether dialup service is "slow, clunky, and almost impossible from overseas," as well as excessively expensive relative to commercially available Independent Service Providers (ISPs). We will continue to maintain the Tether service as it provides functional connectivity for faculty, students, and staff who live off-campus and do not need or have access to faster cable modems or DSL services. At the same time, we will continue to explore other connectivity options. Tether rates will become $10/month effective July 1, 2001.

Higher-Speed Network Service

Our goal is to deliver ubiquitous 100 Mb/s network service to the desktop at MIT. The largest impediments facing us are the needs to replace aging wiring and address the lack of communications (phone) closets that can accommodate 100 Mb/s network services. We are committed to extending 100 Mb/s service throughout the campus as rapidly as space can be identified for communications closets. Given current space assignments, space for these new closets will often need to be provided by departments, laboratories, and centers who desire 100 Mb/s service in their areas. Work is currently underway to build new closets and completely rewire Building 8; we are currently investigating doing the same in Buildings 1, 3, and 68. Similar work has recently been completed in Buildings 66 and 33. We are also carefully reviewing campus buildings to identify where 100 Mb/s service can be delivered from existing facilities. Costs associated with this work are generally covered by the network rates. (Network rates are set to cover the full cost of providing network service. These costs are not subsidized; nor is there a surplus to subsidize other services.)

Network Installation

It is clear that faculty want quicker response times between requests for network connections and their installation. Last summer, a team was formed to focus solely on the voice, data, and network installation process. This team will work to do a better job of acknowledging requests, improving scheduling and timeframes, and keeping customers informed. As we gain more experience with these new processes, we will publish performance measures for this work.

Wireless Service

By the end of June, 2001, we expect to provide wireless network service (IEEE 802.11b) to all of the Institute's classrooms and libraries, as well as some public areas including the Student Center. For customers directly connected to MITnet, there is no additional cost for wireless service. IS will work with those departments, laboratories, and centers who wish to extend the wireless infrastructure into their areas.

Desktop Computing and Hardware Support

We recognize that current faculty needs for desktop computing are generally met. Our goal is to maintain the current satisfaction level while expanding the services we make available. We are currently in a rebidding process to select a new preferred vendor for hardware purchases; this should improve the level of service and price advantage over our current preferred vendor, NECX. We expect the new vendor to be in place by September, 2001.

What is IS and What does it Do?

Information Systems (IS) is responsible for ensuring that MIT's information technology (I/T) resources are aligned with the Institute's strategic priorities while ensuring that I/T services are consistent, reliable, easy to use, and operated productively and cost-efficiently.

IS fulfills an essential role in furthering MIT's core missions of education, research, and service by working in partnership with members of the MIT community to apply and help them apply I/T to reach their goals. Every year, IS receives some 100,000 requests for help and service changes, ranging from upgrading telephone service to installing a new office computing environment to assisting faculty in using computers in their teaching. Faculty, students, and staff in academic departments interact with IS in obvious ways daily: they call the Computing Help Desk with Macintosh, PC, hardware or software questions, or they call the Business Liaison Team (BLT) with questions about business applications. But departments also rely on IS in more intrinsic ways. When anyone at MIT turns on a computer – in an office, in an Athena cluster, in a lab – and sees the network; when someone picks up a telephone receiver and hears a dial tone; when someone backs up the documents and data on their computer to the data center in Building W91, they are interacting with IS.

IS's goal is to provide a world-class technological environment for MIT's world-class faculty and students and staff. To this end, IS provides "commons" services such as computing help, voice and data network connectivity, data storage, software acquisition and support, and the Athena computing environment. IS's services range from strategic partnerships at the MIT-wide level to operational services and support at the departmental and individual level.

Making use of I/T requires resources: physical resources (such as space for staff and equipment including phone closets in departments, laboratories, and centers); human resources (such as staff time for training, retraining, and problem resolution); and monetary resources (such as equipment, and software acquisition and renewal). Many of IS's wide range of services are freely provided to departments, but others (such as telephone and network services) are provided on a cost-recovery basis or through competitive rates to cover the costs of these resources.

You can find additional information about IS, its organization and services, at <http://web.mit.edu/is/>, or you can contact Professor James D. Bruce, vice president for Information Systems (jdb@mit.edu, 3-3103). You can find information specifically about academic computing services and support at <http://web.mit.edu/acs/instr-comp.html>, or you can contact Dr. Vijay Kumar, director of Academic Computing (vkumar@mit.edu, 3-8004).

Software Support

Recently, IS put in place a Software Release Team to make necessary customizations to software (e.g., so that it does not impair the functioning of another supported application), and then package, document, and distribute it for installation. This has addressed many outstanding issues in the software support area. Additional improvements continue to be made. For example, we are working to announce forthcoming software releases in a more timely way, and to follow these announcements with an equally timely software release. We are exploring additional volume licenses for software, paying special attention to academic needs, and developing an easy guide for finding useful information about software.

Web Development

We recognize the increasing interest from faculty in using the Web for course-related materials. Faculty Liaisons (f_l@mit.edu) and other consultants in IS provide office visits, and the staff in the Electronic Media Creation Center (EMCC) are available to help. We are also working with the Registrar to upgrade classrooms to support increasing use of electronic media.

In summary, we are committed to moving forward in each one of these areas. We appreciate your responses to our survey and your interest in Information Systems, and we recognize the critical importance of working with you to align our future efforts with your needs and the needs of the whole Institute. Please feel free to send e-mail to me with any comments or suggestions about this article or IS.✤

[James D. Bruce can be reached at jdb@mit.edu.]

Prioritizing Projects in the Department of Facilities'
Infrastructure Renewal Program
Joe Gifun and Caleb Cochran

Angie: What do you wanna do tonight?
Marty Pilletti: I dunno, Angie. What do you wanna do?

This exchange is repeated many times throughout the 1955 film, *Marty*. Marty, a shy butcher from the Bronx, finally takes responsibility for his own happiness and sets out to woo a woman he met at a dance. While deciding with whom you would like to spend the rest of your life, as Marty was, is certainly an important and complicated decision, look how difficult it was for Ernest Borgnine (Marty) and Joe Mantell (Angie) to make a simple decision. When a decision is very important, when the opinions of many people must be considered, and when the stakes are very high, the level of difficulty expands dramatically. Thus, the need to simplify the decision making process.

In the Department of Facilities' Infrastructure Renewal Program, we are beginning to use a methodology based on multi-attribute utility theory, developed by Professor George Apostolakis and MIT graduate student Rick Weil, to prioritize projects intended to renew the existing campus buildings. According to the report entitled *Infrastructure Renewal at MIT: Planning, Persistence and Improved Communication*, published in February 2001, infrastructure is defined as, "A process of systematically evaluating and investing in maintenance of facility systems and basic structure." That is, a process to make our existing campus buildings and their systems whole and prevent them from deteriorating once again.

The first question one may ask is: "Why would the Infrastructure Renewal Program need a methodology to make decisions about the selection and prioritization of projects?" The answer is, there is much work to do on the existing infrastructure and not enough resources (nor is it practical) to do them all now. Since 1957, the floor area of MIT buildings on campus has tripled and these buildings have all reached their maturity. Systems are no longer new and in many cases need to be replaced or substantially updated. From an independent audit of building structure and systems completed several years ago, we learned that we have a backlog of deficiencies that is projected to be $800 million in the next seven to ten years. Therefore, Facilities needs to make effective decisions that make the best use of every dollar invested in our infrastructure. As mistakes will be expensive, we need to focus on the most important projects first. We need to determine which project gets funded now and which projects are set-aside for consideration at a later date. Even if we had all the

money, people, and resources necessary, we would still need to determine the order in which projects will be done, as they all cannot be done at the same time.

We learned from Professor Apostolakis, Mr. Weil, and Dr. Dimitrios Karydas that the best way to determine the importance of a project is to look at it through the filter of risk. What could happen if you do not do the project? Risk-informed decisions help you focus on a project's possible impact, good or bad, by excluding cost, emotion, and politics. Each project is ranked according to its individually derived measure of impact or importance. Cost, emotion, and politics are certainly considered, and they cause one to make subsequent adjustments to the order, but only after a project's ranking is initially determined. This allows you to know the risk of not doing the project you have selected to bypass. To get to this point, one needs to determine criteria by which you, or the team, will make decisions. In Facilities, the Infrastructure Renewal Core Team is responsible for prioritizing projects. The team is made up of Facilities' decision makers with backgrounds in engineering, architecture, utilities, building operations, space planning, and finance.

Mr. Weil and Professor Apostolakis's methodology was adapted to fit Facilities' needs by Dr. Karydas of FM Global (MIT's insurance provider) and members of Facilities' leadership. Dr. Karydas, whose expertise is provided graciously by FM Global, has much experience in risk-informed decision making. Facilities proceeded as follows:

1. Identify and define objectives
2. Identify and define performance measures
3. Weight objectives and performance measures
4. Create and assess utility functions of performance measures
5. Perform consistency checks
6. Validate results through bench-marking

Although it is not specifically enumerated above, deliberation among decision makers is an important aspect of the methodology and must take place throughout the process. Decision makers must create agreed upon, easy-to-understand objectives, performance measures, and utility functions, and make many pairwise comparisons. A pairwise comparison is nothing more than a decision-maker's preference for one criterion over another and by how much. For example, Facilities' core team slightly favored, by 6:4, minimizing the impact on people over minimizing the impact on the environment. To learn how we deal with differences of

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opinion, let's presume that all but one decision-maker moderately favors one criterion over the other while the lone decision-maker is diametrically opposed to the extreme degree. One may say that a geometric mean of the decision makers' individual votes would provide a good answer. If all votes are close, then yes, the geometric mean is appropriate, as it is very hard to resolve the difference between adjacent rankings, and confusing the issue with false accuracy is not helpful. But the real value of the deliberation is to determine the reason for the extremes. In our experience with Facilities decision makers, it was not because one did not understand the question before them; it was because they had information or a perspective the others did not have. This result aligns directly with the research of Mr. Weil and Professor Apostolakis. For example, one team member may be more sensitive to regulatory issues because he or she is the one who frequently interacts with regulators. The key is to learn about the other team member's position and come to an agreement.

Our objectives and performance measures look like this:

I. Impact on Health, Safety, and the Environment
  (Weight: 0.491)
  A. Minimize the Impact on People (Weight: 0.600)
  B. Minimize the Impact on the Environment
    (Weight: 0.400)
II. Economic Impact of the Project (Weight: 0.231)
  C. Impact on Property and Academic and Institute
    Operations (Weight: 0.600)
    a. Physical Property Damage (Weight: 0.210)
    b. Intellectual Property Damage (Weight: 0.550)
    c. Interruption of Academic Activities and Institute
      Operations (Weight: 0.240)
      (a). Duration of Interruption (Weight: 0.333)
      (b). Cost of Contingencies (Weight: 0.333)
      (c). Complexity of Contingency Arrangements
        (Weight: 0.333)
  D. Loss of Cost Savings (Weight: 0.400)
III. Coordination with Policies, Programs, and Operations
  (Weight: 0.276)
  E. Impact on Institute Image (Weight: 0.500)
    c. Internal Public Image (Weight: 0.400)
    d. External Public Image (Weight: 0.600)
  F. Programs Affected by the Project (Weight: 0.500)

The Infrastructure Renewal Core Team agreed that the three highest-level criteria would be Impact on Health, Safety, and the Environment; Economic Impact of the Project; and Coordination with Policies, Programs, and Operations. Weighting was agreed upon using a series of pairwise comparisons and deliberations among team members. The Analytic Hierarchy Process (AHP) is the mathematical tool that helps one resolve the pairwise comparisons and was developed by Professor Thomas L. Saaty, formerly of the Wharton School at the University of Pennsylvania. Using a scale of 1 to 9, Core Team members indicated their preference of Impact on Health, Safety, and the Environment versus Economic Impact of the Project, the Impact on Health, Safety, and the Environment versus Coordination with Policies, Programs, and Operations, and the Economic Impact of the Project versus Coordination with Policies, Programs, and Operations; where 1 represents equal preference of the two criteria and 9 represents the extreme favoring of one criterion over the other. This results in the matrix as shown:

	Health, Safety and the Environment	Economic Impact of the Project	with Policies, Programs, and Operations
Impact on Health, Safety and the Environment	1	2.5	1.5
Economic Impact of the Project	1/2.5	1	1
Coordination with Policies, Programs, and Operations	1/1.5	1	1

Through AHP, the matrix is resolved to its eigenvector and the relative weights of the objectives are determined. They are: Impact on Health, Safety, and the Environment 0.491; Economic Impact of the Project 0.231; and Coordination with Policies, Programs, and Operations 0.276. The AHP tool helps decision makers evaluate the consistency of their decision, i.e., to be certain that if A>B and B>C then A>C. That is, a minor disruption in a program must not outweigh a potential expense of millions of dollars. Core Team members deliberated once again to be certain that the relative position of each objective makes sense. If the decision was determined to be inconsistent or if a decision maker was uneasy with the

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relative position of the objective, the pairwise comparisons and deliberation process was repeated. This process is repeated until the relative weights of all performance measures are completed.

Creating and assessing the utility functions from constructed scales of each performance measure is our next step. The more specific and measurable each level is, the easier it will be to use. Once done, they will become the entry points to the entire prioritization process. For example, the constructed scale for property damage might be:

Catastrophic property damage (more than $10M)
Major property damage ($5M to $10M)
Moderate property damage ($1M to $5 M)
Minor property damage (less than $1M)
No property damage

Similar to the objectives and performance measures, pairwise comparisons are made for each element of the constructed scale and relative weights subsequently calculated.

When all of the above is completed for all performance measures, we will validate our work through benchmarking. As determined by Rick Weil and Professor Apostolakis's research, we would pass several known projects through the process and make sure the results obtained through the methodology match our experiences. This year the Infrastructure Renewal Program created their FY2002 project list using an earlier iteration of this process and found that the results matched the list we produced from internal deliberations alone.

To use this process, Infrastructure Renewal Core Team members asked the question: "What would happen if we do not do the project under consideration in the context of each performance measure?" Their answer to this question is entered into the application and a numerical representation of the project's importance is the result. Once this is done for all projects in consideration, a list of projects in order of their importance is created. Unless other compelling reasons are present, the projects with the highest numbers are to be done first.✣

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M.I.T. Numbers

Spring 1999 Survey of Enrolled Undergraduates
(N=1,036)
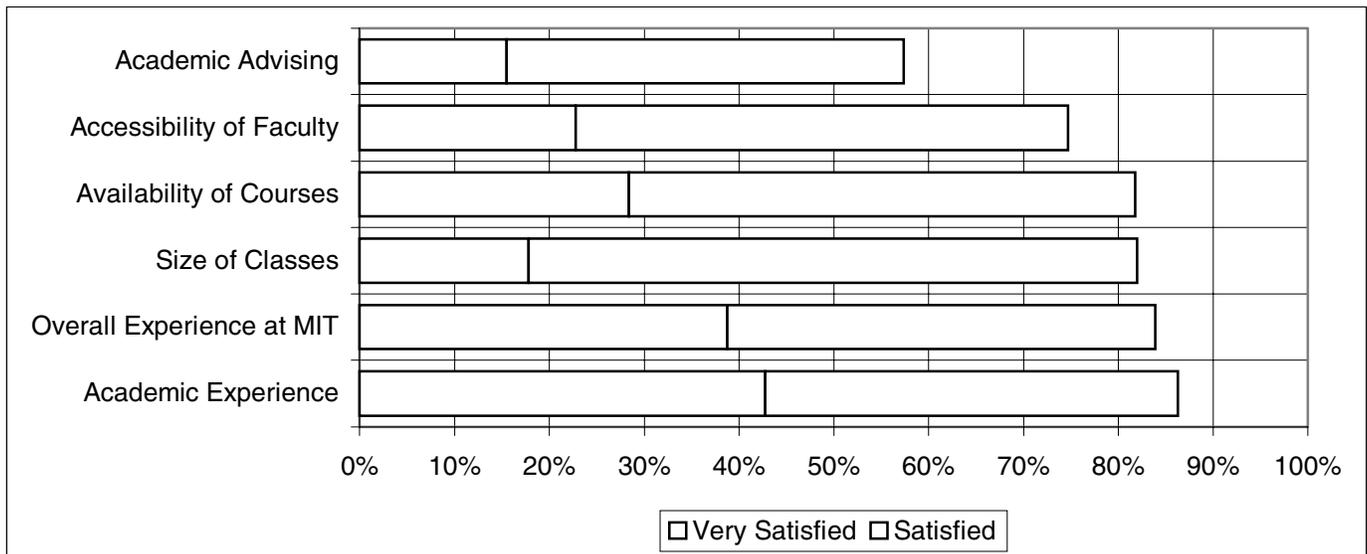
Source: *Office of the Provost*

From The Libraries

Digital Initiatives

Ruth K. Seidman

Current library initiatives reflect two of the directions of the MIT Libraries' Strategic Plan. One is "to excel at providing rapid, easy and precise access to high quality information for education and research at MIT." In this area the Libraries are in the midst of a number of operational projects. A second strategic direction for the Libraries is "to be a leader among academic research institutions in the use of applied library technology." Moving this forward are several research projects.

Operational Initiatives

On the operational level, the Libraries' Website is being redesigned, both in its presentation of information and in its look and feel. The staff first obtained input from the MIT community through surveys and observed usability tests. Using the results of the tests, a more user-friendly terminology and different ways of organizing the information were developed to present the site's content. Following this, library staff worked with a design firm on the graphic presentation. During spring 2001 the public will be invited to preview the new site, which is planned to go live during the summer.

Another major project is the implementation of a new library management system, *Ex Libris Aleph 500*, to replace *GEAC Advance*. This new Web-based system will provide significant enhancements for the online public catalog, *Barton,* and for all of the library's functions, such as the circulation of library holdings and the ordering, receipt, payment, and cataloging of new materials. Data conversion and staff training are underway, and the Online Public Access Catalog (OPAC) is being developed to meet MIT's needs. As with the new Web design, MIT students are participating in usability tests. It is anticipated that the new system will be available in July 2001.

The MIT Libraries are beta testing software for a digital reference system. The project is called *Ask Us! – Live* and it offers real-time online assistance to those not physically in the library. In this way, expert research assistance will be made available remotely to members of the MIT community.

The system will allow for one-on-one conversations online between librarians and those using library resources with a combination of chat and co-browsing (the ability to send and share Web pages over the Internet). Users and librarians can jointly search databases, navigate through Web pages, and fill out forms together. Those interested in participating in the test phase of this project are invited to access the service through <http://libraries.mit.edu/ask>.

Finally, in the operations area, it should be noted that the MIT Libraries continue to bring to the campus a wide array of resources in electronic format. At last count, available through the Libraries' Website are 223 electronic databases and 3090 electronic journals. Some databases of particular interest are *Derwent Innovations Index*, providing access to world patent literature, and *The New Grove Dictionary of Music and Musicians*, containing over 29,000 articles and linking to images and digital sound. Another notable digital resource is *Books 24x7*, offering the ability to search, browse, and view the full contents of hundreds of books related to both the technical and business aspects of the computer industry.

Research Initiatives

Beyond the operational initiatives of the Libraries, are research projects. The first of these was reported last year in the April/May 2000 issue of *The MIT Faculty Newsletter* in an article by Margret Lippert Branschofsky, "From the Libraries – The DSpace Project." Branschofsky described the joint project of the MIT Libraries and Hewlett Packard to build an archive for the approximately 10,000 digitally formatted documents produced annually by MIT faculty, researchers, centers, and labs. Documents include technical reports, articles, and other electronic content deemed valuable. Formats will include text, images, audio, video, and datasets. When in production, the archive will allow for submission, retrieval, searching, access control, rights management, and publishing capabilities.

During the summer of 2000, the Mellon Foundation awarded a grant to the MIT Libraries to develop a business model to find ways to sustain DSpace beyond its time as a research project. This work will address the economics of maintaining an academic digital depository over time; the knowledge gained will serve to inform the digital initiatives at other universities as well.

The DSpace Advisory Board has been formed and held its first meeting in December. Members are: Anne Beamish, Erik Brynjolfsson, James Buzard, Eric Celeste, Catherine Friedman, Jerome Friedman, John Lienhard, Gareth McKinley, William Mitchell, Jerry Saltzer, Richard Schmalensee, Robert Stalnaker, Bruce Tidor, and Ann Wolpert.

Currently an online survey is underway to determine preferences for submission features on the part of content contributors. Faculty members are encouraged to participate by entering the DSpace Website, <http://web.mit.edu/dspace/> and clicking on SURVEY.

In a related research area, the Libraries received a planning grant of $145,000 from the Mellon Foundation for the development of an archive of dynamic electronic journals. These are scholarly Websites that provide a broad range of rapidly changing content. An example of this new form of publishing is the MIT Press Cognet, started in September 2000, to create an online community for researchers in cognitive and brain sciences. Other publishers, such as Columbia University Press and the American Association for the Advancement of Science (AAAS), are also developing dynamic electronic journals. The MIT Libraries will work with publisher partners to investigate strategies and technologies to create a model for a workable repository for this new type of scholarly publishing.

It is anticipated that the operational initiatives described here will provide improved service at MIT and that the research projects will benefit both MIT and the larger scholarly community.❖

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Student Leaders Report

Undergraduate Association

A Plea for More
Student-Faculty Interaction

Peter Shulman

Are you sick of hearing about the importance of Advising? Of Faculty-Student mentoring? Well, tough. This is my last installment in the *Faculty Newsletter* as president of the Undergraduate Association before turning over the reins, and I'd like to conclude with an issue that brought me into my position in the first place.

(Incidentally, this piece might appear a bit more polemical than usual, but at times, tact must be sacrificed in order to make a point. But before I continue, please know that many, and perhaps even most, of the faculty at MIT care deeply about undergraduates and their educational and personal needs, and the pedagogical techniques and personal behaviors of these faculty members reflect that. But many have yet to appreciate how strong a role in the lives of undergraduates they do have, or could have. This is what I'd like to address.)

At the beginning of the year in this column, I asked faculty to learn the names of their students, in an effort to interest students in a subject where the professor has demonstrated an interest in them.

Did you? For those who did, did it work?

Do you offer a Freshman Advising Seminar? If not, why not? Do you even know what they are? This year, 93 Freshman Seminars were offered. Most were taught by faculty members.

But aren't there almost 1,000 faculty members?

Yeah, that's right. So where are the other 900 faculty members!?

This column is a plea for more Faculty to interact with Students, and more Students to interact with Faculty.

At this point, at least two different relationships should be distinguished: Advising on one hand and Mentoring and Informal Interaction on the other.

Advising refers to the existing system pairing students within a major with faculty in that department. Currently Advising is administrated by individual departments. This is what the UA Sub-Committee on Advising has focused its research on. The current system has many strengths, and also many weaknesses. Being departmentally organized, the current system allows students access to faculty who should know the department well. But outside of Reg Day, there are few reasons why a faculty Advisor necessarily has to meet with advisees. We have all heard about the students who only see

Graduate Student Council

Best Practices in
Graduate Advising

Soulaymane Kachani

Graduate advising is a topic that affects the well-being and livelihood of graduate students in ways that few other topics do. Alarmingly, significant number of students report that they face problems with their advisors. In truth, the number of cases where students face such problems and do not openly admit to them is even larger. What is more worrisome is that students are unaware of sources of advice and help available for them.

The nature of problems reported by students generally center around four main areas: funding, thesis completion, work practices, and mentoring.

In an effort to address these perennial problems, the Graduate Student Council raised the issue of advising with the Corporation Joint Advisory Committee (CJAC). CJAC, together with GSC, conducted a thorough survey of good practices in advising and mentoring in different departments at MIT, as well as at other reputable institutions. From these, we identified specific practices that will help alleviate the common problems faced by graduate students. In this article, I present a summary of recommendations from the "Best Practices in graduate advising" that were presented by CJAC members to department heads on April 2, 2001, at the department heads luncheon chaired by President Vest. The PowerPoint presentation is available at <http://gsc.mit.edu/advising.html>.

Guaranteed funding for first-year students is a strong recommendation from CJAC. This will help in providing time for new graduate students to shop around for advisors. Most cases of conflicts that arise between students and faculty are due to students rushing to take up RA positions without really considering their options. Time to shop around will enable students to find faculty that have interests and mentalities comparable to that of the students. This will also enable students to take time and talk with members of that particular research group about the "way things are done" and see if these are what the student appreciates as well. Another advantage of this is that International students will not have to face severe problems in applying for visas since the availability of guaranteed funding is a requirement for obtaining visas.

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their Advisors on Reg Day, and then for only a few minutes to sign forms (and should the Advisor for some reason object to signing a form, the advisee simply switches Advisors).

Mentoring and Informal Interaction, on the other hand, occur whenever faculty and students interact in some educational or social context. UROP professors often serve in this role, as do course instructors with whom students turn for advice, academic or otherwise. Some students meet faculty when they serve on Institute Committees, though only a small fraction of students participate in this opportunity. Housemasters, too, serve this role for many undergraduates.

In an ideal world, all students and all faculty would participate in both of these activities. But why? As I reported in my first column, I once had a conversation with a professor who questioned why learning the names of students is important. The answer I gave is that it provides incentive for the student to develop an interest in the material. As accomplished researchers and leaders in the MIT and world academic community, faculty here, whether they like it or not, are models for students. The really inspiring ones have the potential to influence not only the university experience, but also the careers and life-paths of their students. This is quite a power, and while many faculty wield it wisely, many others do not.

Today, all forms of faculty-student interaction are being scrutinized throughout the Institute. The Faculty Committee on Student Life (CSL), chaired by Aero-Astro Professor Paul Lagace, has dedicated itself to the informal aspects of this relationship. (Case in point: Professor Lagace, GSC President Soulaymane Kachani, and I

met several months ago to discuss the CSL and needs of students. Perhaps 30 minutes into the conversation, we drifted off-topic when I learned Professor Lagace had been involved in both the UA and the GSC when he was a student here. After a couple of questions, I apologized for moving away from the topic of the meeting, when we recognized it was just this sort of student-faculty comfort and conversation we were striving to develop, especially for students who, unlike myself, are not forced into talking with faculty on a regular basis.)

On the UA end, over Registration Day for Spring 2001, we ran a survey for undergraduate upperclass students (another reason not to have Reg Day entirely on-line). The survey represented a first step in understanding the current state of departmental advising. Over 400 students responded. As was emphasized when the results were presented, this data is preliminary, and while many results are instructive, others only point to where more data is needed.

One question asked was whether your advisor (traditional academic departmental advisor) knew you well enough to write a recommendation for you. The results were striking. Course VI (Electrical Engineering and Computer Science) had 162 respondents, and 80% of them believed their advisor did not know them well enough for a recommendation. Eighty percent! (Please note, I am not picking on EECS for any reason other than the high number of responses, which indicates some reliability of the data.)

But what does raw data like this tell us?

It's actually not too easy to interpret. Does it mean that EECS faculty ignore students (I hope not)? Does it mean that

EECS students avoid faculty (maybe)? Does it mean many students in EECS are so unhappy with their choice of major (as far as personal satisfaction goes, not intrinsic quality of the department) that they avoid any unnecessary communication with their faculty? Does it mean that the large number of students in the major drives shyer students to the back of the classroom?

Maybe the question itself was phrased wrong, and the 80% of EECS students surveyed could not have their *official* faculty Advisor write the recommendation, but know others within the department who could.

In response to these concerns, the UA and GSC, working closely with the developing Office of Alumni Engagement, the Alumni Association, and MIT IS, have developed a Microsoft iCampus-funded program to expand the Alumni Association's Infinite Connection database to include current students and faculty as well. We hope this will open channels of access between students and faculty on campus (as well as with alumni off-campus), and serve as a resource in developing student-faculty-alumni interactions in the future.

The point is, we have a four:one undergraduate:faculty ratio, and with the brightest students and faculty on the planet, that not enough of each interact is a tragedy. As we move toward the end of the semester, and into the summer and fall of 2001, I implore the faculty to make interaction with students, both formally and informally, a priority for the future. And for the students reading this, I implore the same – if you've never spoken to a professor of yours, it's time to do so.❖

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Best Practices in
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Another benefit of the guaranteed funding for the first year is in minimizing the situations where faculty hold students for "ransom" in the first few semesters to accomplish research targets. This, it seems, is a familiar trend among some younger faculty on tenure track. International students have been especially exploited by this rather horrific practice.

An additional significant recommendation that is aimed at alleviating funding related problems, is the introduction of a "funding certificate" that will enable students to know of their funding status for the upcoming year or semester (as appropriate in the department) to be signed by the principal advisor providing funding for the student. This document will include three options: "I will definitely fund the following student," "I am not sure about funding the student" (with reason such as not sure of approval of funds from funding agency), and "I will definitely fund the student." If this document is signed and made available in time before the TA deadlines, this will enable students to either take up a TA in time to compensate for a semester or look for other sources of funding.

Along these lines, the availability of departmental funds for allocation for such cases of abrupt lack of funding will also help students greatly.

In the work practices side, most of the causes of conflicts that do occur are due to poor communication channels and insufficient contact time available between students and their advisors. A recommendation to ensure at least once-a-semester appraisal of student progress between the student and his/her faculty advisor will go a long way toward reducing the miscommunication and "expectation" problems that commonly occur. A written document (which is currently the practice in Materials Science and Engineering) enables a detailed discussion between the student and faculty on the accomplishments of the semester, what can be reasonably expected in the coming semester, and specific goals that should be aimed at.

Along similar lines, requirement of at least one meeting a year between a student and his or her thesis committee will enable regular discussions. A written report of these discussions and goals for the research project will enable students to gauge the satisfaction of the thesis committee and help identify the goals they need to get to, to be considered "done." A common point of conflict between students and faculty is when students approach what they consider is time to write up and this is not quite the opinion of his or her research advisor. Complaints of ever increasing task lists near completion could be avoided by having a written document establishing the necessary goals that need to be achieved early on, and at which point the thesis could be considered done.

A major reason for students' advising misadventures arises due to the fact that there are few resources available for students within departments that help solve common problems when they arise. Even in cases where such resources are available, the information is not widely known. The presence of senior student-friendly faculty who act as departmental Ombudspersons will assist a great deal in directing students on right paths towards solving problems they encounter with their advisors, research, academics, and other issues. Identifying a point contact person(s) rather than an office will help a great deal.

Along with these, another major recommendation from CJAC is to have a second faculty member in the student's home department who could act as an academic advisor and someone to whom the student could go to talk about a variety of issues. This second faculty advisor would provide a means for students to approach topics they otherwise would not normally discuss with their main advisor. Also helpful will be the student-faculty interaction, from which students can learn a great deal.

Another recommendation which was based on a practices at the Faculty of Arts and Sciences at Harvard University, is to encourage discussion about conflicts which are bound to occur, and to actively publicize the need to discuss these early on when they happen, and identify sources of help for the students.

Advising is a major challenge and is by no means an easy task. Senior faculty members have a wealth of experience from which junior faculty can benefit. Organizing programs that encourage senior faculty mentoring of junior faculty is another major recommendation under this topic of student mentoring. Possibly a means of training faculty regularly on the topic of advising and handling students will be beneficial to everyone concerned.

These recommendations have the potential to dramatically improve the cases of poor advising at MIT and set world standards in graduate advising which will always help attract the best and the brightest. Implementing them in some adopted form in each department will go a long way toward creating a thoroughly productive and happy experience for graduate students. Please help graduate students in this endeavor by implementing some of these practices in your department.✣
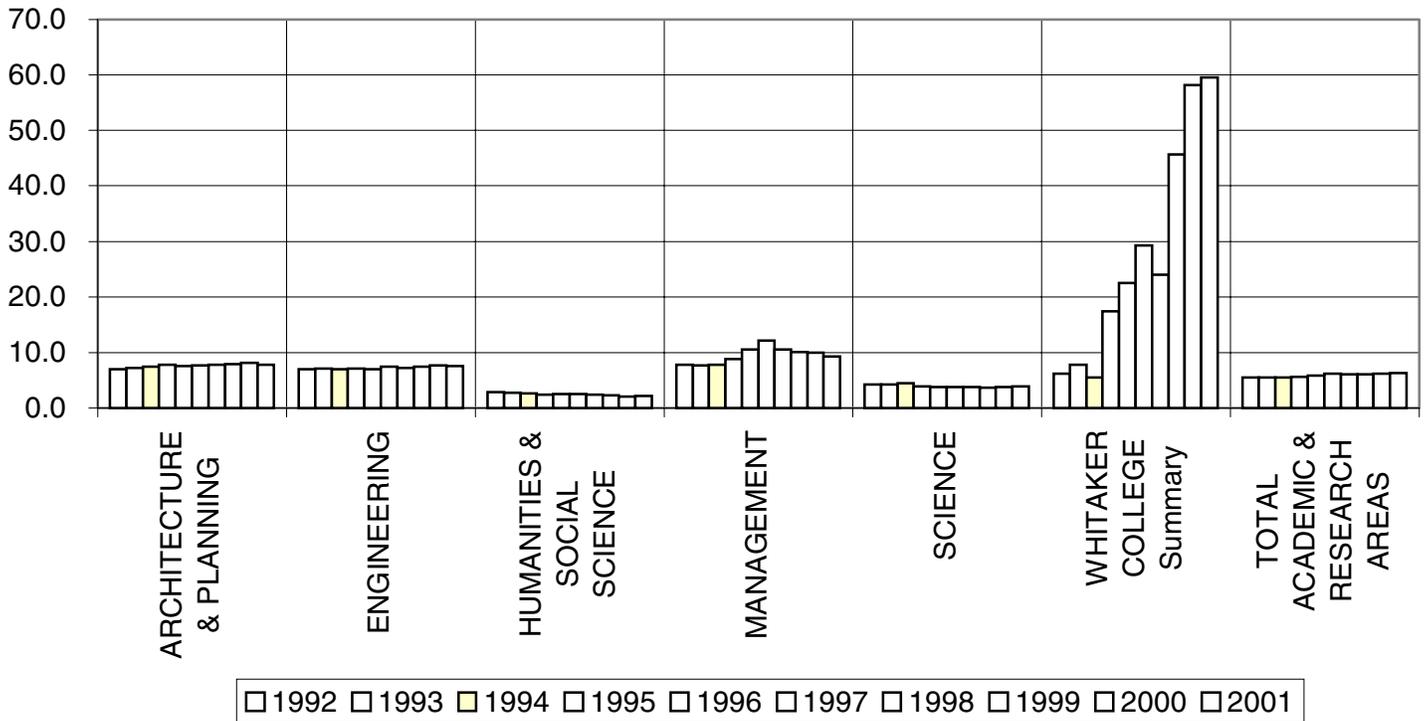
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M.I.T. Numbers

School Comparisons
Graduate Majors per Faculty
FY1992-FY2001

Source: *Provost's Office*