The MIT Faculty Newsletter

Vol. IX No. 4 **March/April 1997**

It *Is* Broken, and We Should Fix It

Lawrence M. Lidsky

The following proposal to make a major change in the Institute Science Requirement is based on a discussion paper prepared by a subcommittee of the 1985 Commission on Engineering Undergraduate Education. The Commission was responding to "a consensus that, while MIT is meeting the objectives for technical education [of Engineering undergraduates], it is falling short of those for humanistic, artistic and contextual understanding." I think now the time has come to reconsider the issue of technical education. I've retrieved and edited the discussion paper, but will maintain the anonymity of the other subcommittee members because this is, after all, a 12-year-old trial balloon. I still think this is a good idea. They can join in the discussion, if they wish.

A strong grounding in mathematics and science is the hallmark of an MIT engineering education. The science-oriented portion of the curriculum is supposed to develop knowledge of the basic concepts necessary to understand the structure and behavior of the physical world, and to motivate mastery of techniques suitable for analyzing complex systems. The benefits of such foundation strengths include enhanced capacity to differentiate the specific from the general, to understand the context of particular specialties, and thus, the ability to cross disciplinary boundaries. This is more important than ever because engineers are being asked to deal with more highly integrated systems, at higher levels of abstraction than ever before.

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TILT and the Role of MIT in K-12 Education

Leon Trilling

The Institute for Learning and Teaching (TILT) is a five-year-old MIT enterprise supported by the Council for Primary and Secondary Education (CPSE). TILT's successes and problems are the focus of this article, but an initial review and analysis of MIT's role in K-12 education perhaps is in order.

As "a university polarized around science and the useful arts," MIT has an interest in the nature and quality of American primary and secondary education, particularly in mathematics, science, and technology. The competence of our students depends on it. So do the skills available to the enterprises in which our alumni work. Also, the Institute, as a leader in higher education and in the creation of new technologies, has a stake in the appreciation of science and technology by the public at large.

The Institute community has expressed that interest in two rather different ways. On the one hand, many individuals and some departments, centers, and laboratories have undertaken a wide range of volunteer efforts. For example, the STEP Program and the Community Service Program place MIT undergraduates in Cambridge Public Schools as teachers' aides for extended periods of time. The Edgerton Center organizes class visits on campus. Many faculty, staff, and students visit schools, lecture there, and provide enrichment of existing programs. The booklet "MIT's Outreach Programs" compiled by Linda Breisch for the Council for Primary and Secondary Education, lists and describes some 50 such activities.

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Editorial

Research Universities After the Cold War

With the rest of the world, MIT faculty members hailed the end of the Cold War with relief and hope for the future. However, joy was quickly followed by consternation on campuses. National leadership intimated that the ephemeral "peace dividend" could be realized not by a stand-down of the military, but by the reduction of funding for civilian programs. Included among these have been basic research and graduate education conducted, in the U.S., largely under the auspices of its research universities. Consternation turned to panic, as conservative leadership elevated minor misappropriation scandals into symbols of profligate misuse of tax dollars. MIT was among the schools most likely to be devastated, as a wing of Congress threatened drastic cuts in research funding. The danger was real; the remedy not obvious.

However, in the last five or six years, the palpable fear among universities faced with federal cuts has been replaced by a more active focus on building the national policies needed for the twenty-first century. Several professional societies under the FASEB coalition have educated and activated their memberships to the importance of the federal budget process and priorities. In the last few years new coalitions have formed to support the critical roles of the NIH and the NSF in university based research. The recent joint statement by the APS, Optical Society, American Chemical Society and Astronomical Society is an important step in the right direction. Members of our faculty have played active roles in these efforts. The education of our colleagues on the importance of the federal budget needs to be extended to our students and our staffs here at MIT.

Another critical factor has been the leadership role played by the current administration. The calm, effective and far-sighted response has helped mobilize university administrations toward a constructive retrenchment of university-based research. In the face of uncertainty, MIT leadership did not retreat, but advanced, building on the most positive elements in the post-Cold War environment – its potential for innovation, internationalism, and new partnerships. In these recent years, MIT has helped place the future of research on a robust new footing, founded in new realities, and characterized by distinct, though inextricably linked initiatives.

President Charles Vest has developed a new rapport with members of the Washington establishment who understand the importance of basic research to the national economy, and are less coupled to weapons development. MIT set up an office in the District, and worked at many levels, with diplomacy and discretion, impressing upon those who would listen, the critical need for high level research and development as the keys to our educational and industrial future. Vest's efforts have contributed to the national mobilization of faculty and administration that has temporarily mitigated the threat of massive federal cutbacks.

Complacency, however, is dangerous. President Clinton's current budget does not cut R&D in the near future, but does propose over a $450 billion cut in federal spending to kick in after 2,000. As Rep. Barney Frank pointed out in a recent meeting with biomedical scientists, given the projected maintenance of the military budget, civilian R&D and education will be severely squeezed. The budget issues are likely to intensify. However, through a combination of leadership, foresight, and finesse, MIT leadership has helped construct a new rationale for research, detached from Cold War concerns, and based on the future the American people now seek.

Second, MIT leadership is encouraging an international perspective in a wide range of educational and research programs. The faculty and administration recognized early that the end of the Cold War presaged a burgeoning globalization of economic activity. The energy of millions, formerly locked up and wasted on hostility and secrecy, has been released for more constructive purposes. This energy, and the ambitions it fuels, cannot be confined by national boundaries. Neither can the research underlying innovation in science and technology. Riding the crest of this wave, the administration and many faculty recognized that only an international university can lead a global economy.

This perspective has enriched education and research at MIT in every school. Many units are positioning themselves uniquely to capitalize on the intellectual opportunities all over the world, and to participate in global opportunities for research and development. The Alliance for Global Sustainability, and collaborative efforts in Japan, Argentina, Taiwan, Thailand, Malaysia, and China represent MIT's interest in new international challenges. MIT students, through opportunities such as the Japan Program, the Germany Program, and the China Program are gaining sophistication and hands-on experience in a wide range of corporate environments. Such programs show highly educated and scientifically knowledgeable young people the workings of R&D, industry, and of leadership, worldwide. This internationalization will bring a host of new problems, in terms of which sectors – politically, economically, socially – we ally with, but coping with these problems and choices are necessary components of such an education.

Thirdly, the current administration is involved in forging new alliances with industry. The future of technology and information-intensive industries will be driven by innovation, and, in this country, fundamental innovations have been the province of the research universities. Our futures are inextricably linked, and will only become more intimate. While MIT faculty and graduates have a long, felicitous history of collaboration with industry, our post Cold War leadership is actively exploring this relationship. It has cultivated, encouraged, and educated industrial

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leadership to learn more, and become involved in MIT's future directions and potential. It has facilitated MIT faculty access to industrial research opportunities.

Major multinational corporations, including Amgen, Merck, General Motors, Ford, and Disney, are now forging research alliances with MIT. These new partnerships have significant potential for the Institute as sources of research support, and also for the intellectual challenges they bring. They also bring serious risks for the intellectual independence of ourselves and our students, following from the motivations of industry. As a branch of human enterprise, it has been traditionally driven by competitiveness, while the ideals of university life have been those of cooperation and neutrality. Insofar as these values are antithetical, careful negotiation, foresight, and awareness are needed to enable parties from both sectors to work together in a mutually productive manner.

The industries that will succeed in the new global economy will be those best able to anticipate solutions to the long-range, complex issues universities are well-structured to address. Add the component of technology to such multifaceted questions, and the unique ability of MIT to deal with them becomes evident.

To address these emerging issues of our future properly, and accurately, we need to cultivate dialogue among all players. This is the mode the current administration must continue to pursue. All three components of this strategy – an open relationship with government, an international perspective, and partnerships with new industries and enterprises – combine to place MIT, and its partner universities, in a new relationship with the world. This relationship is predicated on the most positive, exhilarating, and constructive realities of the post-Cold War world, and will contribute to the well-being of its people. We congratulate the administration for its foresight, persveverance, and success.

Editorial Committee

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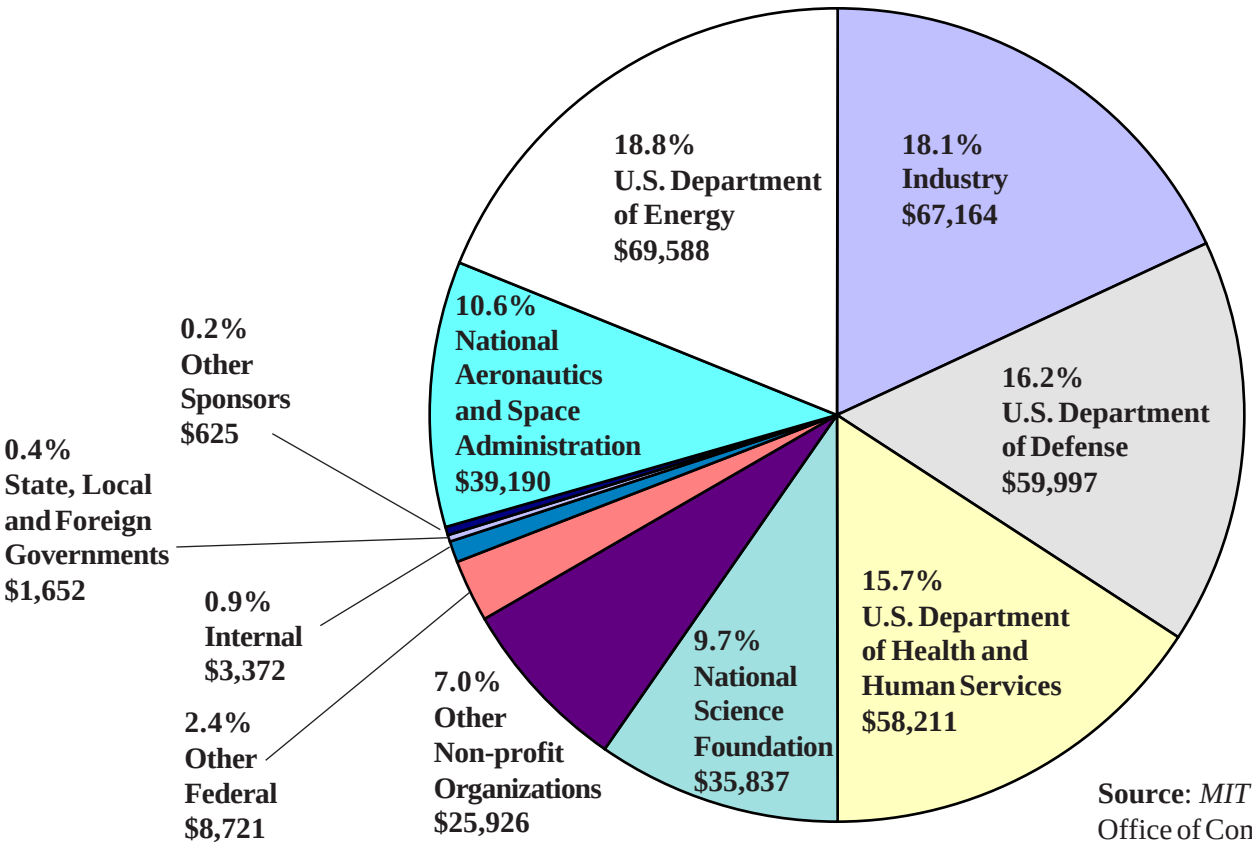

Source: *MIT Facts 1997*; Office of Communications

MacVicar Faculty Fellows

A Teacher's Fan Club

Brit J. d'Arbeloff

Remarks made at the February 7, 1997 MacVicar Faculty Fellows luncheon.

Thank you for inviting me to this wonderful occasion. When I was asked to speak this afternoon, I said aargh... Why me? I now realize that I'm the perfect candidate for this group – a one-person Teacher's Fan Club. An *appreciator* of all you do. I actually became an engineer to avoid becoming a teacher. Even then, I knew how difficult a job it was. I am not making this up. My parents were both born in Europe and had small patience with the American ideal of a liberal education. *That* one could get free at the Oak Park Public Library. They were not going to pay to have me fooling around. I could pick a profession or forget about going away to college.

The only two professions I could imagine were teaching and engineering. We knew no one in the legal profession and medicine involved blood. My orthodontist tried to get me to study dentistry. The thought of spending each day with my fingers in a stranger's mouth was an anathema. I had no idea what engineers did, but my father was one, and he spent every evening in solitary splendor, sitting in his dark-green leather chair – sketching and writing equations in a small notebook – very focused and serene. We would not dream of interrupting him and disturbing his thought processes.

Having been a *teachee* most of my life, I have an excellent perspective on the teaching profession. By my last year in high school, I had experienced only two thrilling teachers: Mr. Rossiter, my geometry teacher, who sped through the material, finishing a month early so that we could read and discuss *The Fountainhead* – about an architect who used geometry, and *A Rage to Live* – about Van Gogh who was also conversant in geometry – among other things. I dimly remember a rather steamy Gaugin biography as well. I had enough sense not to share this curriculum with my parents. At the end of the first marking period, Mr. Rossiter gave me an A, crossed it out, and put a big F on the top of the page, because he said that sloppiness was not a feminine characteristic. The man had a lot of things in his life to work out.

The other thriller, Mr. Colletti, crawled down the aisle and bit a girl on the leg when she was sleeping in class. Fortunately, not *this* girl. The remainder of my teachers were competent, conservative, got the job done, watched their backs – no thrills. Every one of the women was single. In the Oak Park Public School System, a woman was forced to quit teaching if she married. Teaching was tough. Teaching was dull. Teaching required sacrifice. Teaching was not for me.

It was not until I was halfway through Stanford that I realized I might have abandoned teaching too hastily. God knows, I was having second and third thoughts about engineering. When I tried to see my Freshman advisor, I had to go to the Freshmen Men's dorm where he kept office hours because that was where all his advisees were, except me. He glared at me and said, "Why don't you drop engineering now? You will eventually. *They* all do." *They*, I assumed, meant women. This was obviously a self-fulfilling prophecy. Then, I thought he was omnipotent. Now, I realize he was another overworked grad student with thesis problems.

By spring quarter I was tired of having to explain myself every time I took a new course. I was tired of being the only woman in the class. I called home and announced I was switching to psychology. If I had suggested that I were planning a career in rum-running I would have had a more enthusiastic response. My parents said that if I were determined to waste my life, I could do it in Chicago, Illinois and go to Northwestern. If Paris was worth a mass, California was certainly worthy a Mechanical Engineering degree.

Then, I took Bill Kays' Thermodynamics course. I entered the class with great trepidation. If I could have put it off until my senior year, I would have. Unfortunately, I was already putting so many courses off until my senior year – including the three shop courses required – that there was no room. Thermodynamics had the reputation of being the toughest, most abstruse subject offered by the ME department. It was known to make strong men tremble and switch to Economics.

Thermodynamics as taught by Professor Kays changed my career and ultimately my life. He turned on the subject for me. Not only was it manageable, it was fascinating. During the term I watched the complexity and beauty of the subject revealed layer by layer – rather like peeling an onion, but better since it was not necessary to cry. I changed my field of concentration from Design to Heat Transfer and Thermodynamics. Without that class I never would have gone to MIT, never met my husband. My four children owe their very existence to that decision. There were no circus tricks to Kays' method – only clear, rational exposition and a contagious enthusiasm for the subject. The notes I took in his class pulled me through many subsequent courses and professional challenges – until some

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bounder borrowed my notebook and lost it.

That class was the first time I realized what talented teaching was. Oh, before Thermo, I had teachers who were entertaining, or at least not boring. I learned useful skills and information. Never before had I seen someone distill the essence of a subject so that I was able to see it and explore on my own. It took 20 years of my life to find that. I didn't know enough to know I was looking for it.

No wonder. In our culture, teaching is rewarded neither with money nor respect. At the primary and secondary level, the teaching profession has attracted the bottom quartile of college students. At the university level, expertise in teaching has not been punished – unless the time necessary to be a good teacher takes away from the qualities that count – such as published research and the ability to attract funding. This is not unlike many a woman's career. She is allowed to excel as long as everything still runs smoothly at home and she's there with the cookies when the kids arrive from school.

Yet teachers are entrusted with shaping our culture and our knowledge base. Today, with the breakdown of our families, they are often assigned the responsibility for our ethics, morals, and behavior – areas traditionally left to the family and church. As I'm saying this, a contradictory image flashes through my brain – Miss Hope, my four-foot, ten-inch, red-haired history teacher who had in her classroom the entire testosterone-afflicted football team. The very sound of her Cuban heels clicking on the terrazzo hall floor turned aggressive hellions into quivering mounds of clay. Her technique was fear, not persuasion. I am willing to bet that most of those men today may not remember one fact of American History, but none of them has forgotten Miss Hope. Even in the conservative, family-centered 50s, her area of interest was ethics, morals, and behavior. She was effective, but not in her subject. I'm fairly certain she never figured this out.

Under most systems, it is possible to coast along in a self-delusionary fog about one's teaching skills. My Introductory Physics class was taught by the author of the assigned text, who shall remain nameless. Apparently, he felt that everything one needed to know for this survey course was included in the text, from which he read in a rhythmic and soothing sing-song. The only feature which made attending class desirable – other than the paranoid suspicion that one of the TA's was secretly taking roll – was the experiments. His pith balls never behaved as predicted; they repelled when they should have conjoined; they flew apart when they were scheduled to attract. After a bucket of water doused him during a Momentum demonstration, the very threat of an experiment was enough to rouse the heaviest sleeper. We science majors were hungry for entertainment.

During the year I took Physics, my professor won the Nobel prize. In an interview in *The Stanford Daily* he stated that the most important thing he did at Stanford was teaching the introductory course – it enabled him to inspire young people starting out and allowed him to look freshly at the basic principles of physics. At MIT, this man could have retained such a skewed view of reality for no more than one semester. His students would have set him straight.

A few years ago, my husband developed an introductory business course for the Mechanical Engineering Department. He had never done any teaching on an official level, although anyone who has had the experience of building a large organization knows that teaching is a major component in shaping a team. In spite of the huge amount of work, he had a wonderful time teaching the class until he realized that, in addition to grading his students, his students would grade him. He was a nervous wreck waiting for his grades and relieved to find his students generally positive but with a lot of comments and suggestions. The feedback has enabled him to make the course material more effective every term. Without this data it would have been impossible to know how to improve the course.

It is brilliant to ask the student how the professor is doing. Brilliant, but painful and hard on the teacher's ego. Of course, traditionally, we have not been fearful of the *students'* egos. We may want to rethink this and make sure we are encouraging to our students. MIT has always had a fine filter to attract the outstanding young scientist to the school. In fact, most of us who graduated from the Institute in the past harbor a sneaking suspicion that the filter now in place may be too fine to have let us through.

I also know that a number of students now at MIT are worried that they have arrived by some error of judgment on the part of the admissions committee and do not deserve to be here, but other aspiring students we didn't have room for, also deserve to be here. Nevertheless, the *I am not worthy and they will soon find out* symptom is fairly common. It is the lot of the teacher to shore up that fragile ego and let the student soar. This is particularly important with students who have not traditionally pursued a career in science; for example, women and some minorities. Many of these students have to overcome more than the national mistrust of a scientific education. They have to contend with discouragement from their friends, families, and even fellow students.

Our daughter Kate has always enjoyed the neighborhood of the edge. We're never quite sure what she is going to do. I caught her going to her Harvard interview wearing harem pants. Needless to say, she did not get admitted. She is very bright and school was almost too easy for her, since she tends to drift off when bored. I suggested she apply to the Computer Science Program at Carnegie Mellon. I had found programming the nearest thing to instant gratification that I had ever encountered and I was sure that it would be a life she would enjoy as well. (You may notice that when I became a parent, I was no more a

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fan of a liberal education than were *my* parents.) At first, CMU seemed perfect for her. She liked the classes, joined a fraternity – don't ask – and made a lot of friends. Then she started losing interest. I knew we were in trouble when we went to see her during her junior year. We were given a tour of the computer room by a member of the faculty. Kate tagged along. "Ooo" she said, "this is the computer room! I thought *that* was the computer room," she said pointing to the room with all the terminals. Oops. By the time she graduated she had learned that she didn't want to have anything to do with computers, and enrolled at Parsons for another undergraduate degree, this time in Art with an emphasis on Sculpture.

The problem was not that computers were a bad fit. Here was a person with 800 on her Math Level II, a person who does *The New York Times* crossword puzzle in ink, writing as fast as she can, a person with a preternatural ability to win any game known. The problem was that she did not see herself in the intensely male and introspective world of the CMU Computer Science Department and no one was there to let her know there was more to computers than sitting in front of a terminal for days at a time without bothering to shower. For the want of a teacher to say, "of course there are a thousand things you can do with computers that you would enjoy," science lost someone who could have been the Game Guru of Northern California. Instead, Kate runs a clothing store in Holland, has a condo in Cyprus, travels all over the world on business, and knows every emerging rock group in music. Other women who give up on a science career may not do so well. It only takes one teacher to make the difference between success and failure.

Today we are celebrating the teachers who *have* made the difference. I am thrilled to be here to help in the celebration. It's time that we acknowledge the real heroes of our society. Congratulations to you all. I leave you with my favorite comment on teaching, from William Blake, "Teaching, we learn, and giving, we receive."✣

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MIT Women's League Hosts First Power Breakfast

Eve Sullivan and Catherine Taylor

Dean for Undergraduate Education Rosalind Williams was the featured speaker at the first "Power Breakfast" hosted by the MIT Women's League on March 26 in the Emma Rogers Room. Roz spoke to about 25 MIT women – faculty, faculty wives, and staff – about her views of her role and the role of women at MIT. Referring to the history of the Women's League, she noted the importance of women volunteers over the years in helping offset the fiercely competitive classroom atmosphere and in bringing the Institute together, both physically and emotionally "rolling bandages" for the community.

Women's perspectives, she said, are becoming more influential as women join MIT management in larger numbers and become more and more involved in the financial and administrative management of the Institute.

In addition, through the years, women have joined with men in encouraging the Institute to define education more broadly. Acceptance of this broader vision is evident in the creation of a school of Humanities, Arts, and Social Sciences, of the Undergraduate Research Opportunity Program, as well as Mediation, Freshman Advisor Seminars, Family Resource and Public Service Centers, and the Host Family Program.

Roz did not pursue a career until later in life, assuming that her primary role would be that of wife and mother. She noted that there is an uncomfortable and often unspoken barrier between women who work outside the home and women who stay home to care for children or to pursue other interests. She recalls being told by a Wellesley dean to "get some ambition." (As if raising a family were not an ambitious undertaking!) Now she wonders if her college-age daughter sometimes finds career expectations more burdensome than liberating.

In the discussion following Dean Williams' talk, Dotty Bowe, co-chair of the Association of MIT Retirees, expressed concern that the term "volunteering" belittles the real but unpaid work many women do. Eve Sullivan, editorial assistant in the Laboratory for Nuclear Science, suggested using the phrase "community service" instead. Laxmi Rao, technical supervisor in Physical Plant, stated that her department now asks employees to include in performance appraisals their community service to the Institute and the larger community, including IAP, Charm School, United Way, planning a picnic, or participating in mother/daughter day, PTA, and other projects.

Barrie Gleason, manager of the Communications Office, MIT Public Relations Services, planned the morning event with Paula Cronin, chair of the MIT Women's League, and Sis DeBordenave, administrative assistant to the League.

In closing the gathering in time for staff women to get to their desks, Barrie assured the group that the League will plan more Power Breakfasts in the months to come.✣

From The Faculty Chair

The Faculty Chair: A Job Description

Lawrence S. Bacow

Recently, a colleague from EECS stopped by to discuss Reengineering. At the end of a long conversation he asked, "So tell me, what does the chair of the faculty actually do?" It is a good question – one that I could not have answered two years ago. Now that the end of my term is in sight, I know what the job entails.

Arguably the most important responsibility of the faculty chair is to represent the views of the faculty to the administration. Given the demands on the time of the president and the provost, isolation from the faculty is always a risk. Isolation can lead to serious miscalculations. ABS and CMRAE come to mind. A large part of the faculty chair's job is to make sure this does not happen. My predecessor, Bob Jaffe, described this function as the "canary down the mine shaft" role. I prefer Aaron Wildavsky's characterization: "speaking truth to power." How does one do this? By candidly reporting to the president and the provost faculty sentiment on the issue of the day; by participating vigorously in Academic Council discussions; and by organizing opportunities for the president and the provost to interact with faculty in settings explicitly designed to elicit faculty concerns.

One of the dilemmas of being chair is that if you do the job right, you spend a lot of time with the president and the provost. This is not a burden; they are wonderful colleagues. However, such close contact carries with it the risk of co-optation. Is the faculty chair the shop steward of the faculty or a quasi-member of the administration helping to shape Institute policy? Our commitment to shared governance contributes to this ambiguity. While the chair is elected from the ranks of the faculty, the electoral process is quite genteel: one candidate nominated by a committee appointed by the president (in consultation with prior chairs), followed by an uncontested election. In some quarters, this selection process breeds suspicion. It should not.

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Candidates are selected to be chair at least in part because they are strong personalities. No one is better off with a chair who pulls punches. Fortunately, Chuck and Joel share this view. Because the chair enjoys complete independence on Academic Council (other than the president, the chair is the only member whose boss is not at the table) he or she often functions as the house critic. One virtue of a single two-year term (as well as tenure) is that by the time one's comments become predictable and tiresome, another chair comes along.

Another job of the chair is to try to obtain congruence between the agenda of the administration and the interests of the faculty. In addition to working directly with the president and the provost, most chairs attempt to influence policy through their ability to direct the work of the standing committees of the faculty. For example, Bob Jaffe used the Committee on Faculty Administration to focus attention on the need for intellectual renewal of the faculty. This year, the Committee on the Undergraduate Program and the Faculty Policy Committee (FPC) each successfully pushed for renovation of classrooms, and reform of the writing requirement. The FPC has also worked to try to achieve more open discussion about the impact of Reengineering on the community. The officers of the faculty also exercise considerable influence over the agenda of monthly Institute faculty meetings. The faculty chair drafts this agenda which is then finalized in a monthly meeting attended by the president, the provost, and the other officers of the faculty. I have used this agenda setting process to encourage the president and the provost to address issues at faculty meetings of specific concern to the faculty like the budget, government funding of research, and plans for future construction on campus.

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The Faculty Chair:
A Job Description

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Faculty governance at MIT occurs through the work of the standing committees of the faculty. The chair appoints the heads of these committees and coordinates their work through his or her role as chair of the Faculty Policy Committee. Most faculty chairs spend lots of time trying to see that serious differences of opinion are resolved before any issue comes to a vote of the full faculty. Consensus building is a big part of the job. My goal has been to have boring Institute faculty meetings with near-unanimous votes.

The chair of the faculty also spends lots of time in meetings. In addition to chairing the FPC and attending weekly meetings of the full Academic Council, the chair is also a member of two subgroups of Academic Council – the Education Committee and the Promotions Subgroup. The Education Committee is chaired by the provost and consists of those members of Academic Council with professorial appointments plus the director of Libraries. It addresses academic and research policy issues.

The chair of the faculty is a frequent contributor to this agenda. Topics covered this past year included indirect cost rates, tenure clock issues, possible changes in the status of adjunct faculty, and policy towards summer salary. During promotion season, the president joins the Education Committee which is then reconstituted as the Promotion Subgroup. As the name suggests, this group considers all promotion and tenure appointments above the rank of Assistant Professor. I must confess that I have enjoyed serving on this committee. It is an intellectual feast. If you want to understand why MIT enjoys such an extraordinary reputation, read every tenure and promotion case at the Institute over a two-year period. The accomplishments of our younger colleagues are truly inspiring.

Not all committee work is interesting but somebody has to do it. Sometimes this job falls to the chair who represents the faculty on the Strategic Review of Benefits (SRB) Committee, and the Corporation Joint Advisory Committee. The chair also attends Corporation meetings as a visitor. The SRB is an obscure committee with important functions. Faculty input is essential. For example, last year the committee considered changes to MIT's disability policy. In the course of the discussion, the faculty members on this committee learned that disability benefits are calculated as a fraction of nine-month academic salary. At the suggestion of the faculty, this policy was changed so that now disability benefits are calculated based on a share of total compensation including summer salary. I hope you never have reason to appreciate why this change was important.

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Dispute resolution is the least pleasant aspect of the job of faculty chair. Fortunately, MIT is an extraordinarily collegial institution. However, every so often faculty members go to war with each other or with their department heads. When war breaks out, the chair is sometimes called upon for shuttle diplomacy. Similarly, *Policies and Procedures* gives the chair a formal role to play in tenure related grievances. Fortunately, I have had to deal with very few such problems. The chair is also responsible for interpreting and enforcing the rules and regulations of the faculty. Usually this just involves reminding forgetful colleagues to comply with end-of-term regulations.

Last year I attended a dinner in Boston for faculty leaders at neighboring universities. I listened quietly while my counterparts told stories of bitter fights between faculty and administrators. We are fortunate at MIT that we do not draw sharp distinctions between faculty and the administration. Our traditions of collegiality and civility allow us to tackle problems that would frustrate lesser institutions. I have enjoyed being part of this process. I leave the office with far more friends than when I entered, and with new appreciation for the many wonderful people who make MIT the truly extraordinary place that it is. Thank you for the opportunity to serve.✣

Report from the Sub-Committee on Work and Personal Life of MIT Faculty

MEMO

To: FPC
From: Sub-Committee on Work and Personal Life of MIT Faculty
Date: April 3, 1997

The FPC sub-committee on Work and Personal Life of MIT Faculty was asked to consider issues connected with faculty efforts to integrate MIT and their personal lives. The Committee consisted of Lotte Bailyn, Jay Keyser, Bill Porter, and Wiki Royden. Its mandate was to bring to the FPC some understanding of the problem and suggestions on how to deal with it.

The Problem

The problem the Committee was asked to address stems from the belief that it is very difficult for MIT faculty to be successful at MIT and at the same time to have significant involvements with family and community. This difficulty seems to be particularly great for women faculty, especially junior women faculty. There are a number of indicators that support this belief.

Anecdotally, one hears that graduate students and post docs are not pursuing academic careers because they do not like the life style they see their professors leading. Also, reports from the study of women faculty in the School of Science indicate that junior women faculty find it exceedingly difficult to have children while on the tenure track. Results from the report of the Elias committee indicate that junior men faculty whose wives are pursuing demanding careers, a growing number, share this difficulty. That report also provided poignant quotes from successful senior male faculty about the family sacrifices they had to make in order to pursue their careers.

There is also evidence of stress from the faculty survey. The attached data show that non-tenured faculty are under considerable stress (women more than men) but the dramatic drop in stress after attaining tenure only occurs among men. The pattern repeats on the question asking for extensive pressure from research and publication demands: both male and female non-tenured faculty report considerable stress from these demands; with tenure, there is a drop in this pressure but it is much less for women. Also, women report considerably more subtle discrimination than men do. Men, however, seem to indicate more marital friction and more problems with children (these data are very sketchy, hence not attached).

These data support the belief that MIT faculty have difficulty combining their careers with significant aspects of their personal lives, and that this is true particularly for the women faculty. That this difference is not likely to be generational, and hence not likely to change just with the passage of time, is supported by the attached data from the student survey. More women than men students report very high pressure and indicate that this pressure is detrimental.

The Committee therefore concludes that there is a problem for MIT faculty to combine their work with significant involvements in family or community. This situation creates personal stress, as shown above, but the Committee believes it also is a concern for the Institute and its goal of remaining the preeminent institution in its chosen areas by means of a world-class, top notch faculty.

Despite the fact that MIT has been well served by its current recruitment, evaluation, and promotion practices, certain changes in the life styles of the faculty and the students may mean that these selection practices will not serve as well in the future. Faculty are less likely to be men with spouses who can support the rest of their lives and students are more diverse and are moving in more varied directions demanding new and different relations with the faculty, both in the classroom and outside.

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FACULTY

% who indicate extreme stress

	men	women
non-tenured	56%	77%
tenured	22%	61%

% who say research/publishing demands are extensive

	men	women
non-tenured	61%	58%
tenured	20%	41%

% who report some or extensive subtle discrimination

	men	women
non-tenured	16%	51%
tenured	6%	34%

STUDENTS

% reporting very high pressure

men	women
47%	59%

% for whom this is detrimental

men	women
29%	40%

Report from the Sub-Committee

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The Committee therefore believes that these problems are more than individual issues and have a potential negative effect on the Institute as a whole. In particular, the Committee believes that under current conditions it is difficult for certain segments of the MIT faculty (mainly women, men in dual career relationships, and single parents) to make it. There is, therefore, a homogeneity in the faculty that do make it through the system – i.e. primarily those without serious commitments to anything outside their work – who might not be the best people to be teaching our students and serving as role models for them. Further, theCommittee fears that the behavior that is reinforced by these selection practices may lead to burnout and to a diminution of the creative spirit, and may possibly cut off new and different ways of approaching intellectual problems.

Conclusions

The Committee believes that the problem of faculty difficulty in integrating their MIT work with a meaningful personal life is a problem that will not go away and is likely to grow.

The Committee believes that if the Institute is unable to deal with this problem it will, in the long run, suffer negative consequences.

The Committee sees no easy solution and recommends a continuing process of raising these issues with the faculty and administration in order to make them legitimate concerns for the future excellence of MIT.✣

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Wanted: MIT Faculty to Travel With Curious Alumni to Exciting Destinations

Melissa Chapman

MIT alumni have an ongoing thirst to learn about the world around them and a strong desire to participate in life-long learning programs. Through the trips offered by the MIT Alumni Travel Program, MIT faculty can become involved and reap the rewards of sharing their area of expertise with our curious alumni while traveling to areas around the world.

Faculty can assist in shaping trips into first-rate intellectual experiences for our alumni. The MIT Alumni Travel Program needs faculty members who might be interested in such an opportunity.

MIT Faculty Speak Out

Professor Emeritus Thomas Mahoney traveled for the Alumni Travel Program for the first time in February on an eight-day trip to St. Petersburg. Of his experience, Dr. Mahoney remarked, "I enjoyed spending time and exchanging ideas with the alumni travelers. Most of all, I was glad to have the chance to lead the group on special excursions like the one planned to visit the U.S. Consulate in St. Petersburg."

"I can truly recommend the assignment – it was a great experience," said Ford Professor Emeritus Lucian Pye, of MIT's Political Science Department. Professor Pye escorted an alumni group to China last fall and provided the lecture series. Professor Pye speaks highly of his experience and remarked on the rewards: "The group was made up of people with a high level of sociability and intellectual curiosity, so aside from their responding to the lecture sessions, we had many interesting conversations."

Professor Ellen Harris of MIT's Music and Theater Arts Department hosted an alumni group for the first time last October to Prague in the Czech Republic. Of her travel experience, Professor Harris remarked, "Traveling with the MIT Alumni Program to Prague gave me the opportunity to see a city I had never visited, and I jumped at the chance. For me, Prague is a city steeped in musical traditions, and it was a wonderful experience to explore the city with a group of interesting and energetic MIT alumni."

Please Take Note

You may be approached for lecture/travel assignments by a tour company directly. The MIT Alumni Travel Program discontinued a partnership with this company in 1995 due to poor quality tours and unprofessional practices. Without MIT's permission, this company has been publicizing tours to the MIT Community under the name of MIT and the Alumni Association. We at the Alumni Association seek your cooperation in not providing your services to them. Their trips provide no revenue to MIT and are not of the quality that we provide to our alumni.

How do I find out more?

The program manager for the Alumni Travel Program, Melissa Chapman, wants to speak to faculty who might be interested in providing the lecture series for our 1998 programs. Melissa can be reached by e-mail at <mchapman@mit.edu>, x3-8265, or by fax x8-6211.

If Traveling for an Extended Period of Time is Not Your Thing...

If you travel only occasionally, for conferences, research, or to visit family or friends, let us list you with the Alumni Association's new Speakers Bureau. We provide a general audience of alumni and friends who want to keep abreast of the excitement that is MIT. To learn more, contact Bob Blake HM, in the Alumni Association by e-mail <rblake@mit.edu>, x3-8243; or by fax x8-6211.✣

It *Is* Broken, and We Should Fix It

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We have relied on the Institute Science Requirement, along with a few departmental requirements, to meet these goals. However, over the years, we have tried to fit ever more material into the science core, even as the departmental science requirements were squeezed by disciplinary subjects. In our attempts to teach too much, our students learn too little. They develop neither the conceptual coherence nor the analytic capabilities that we think are necessary. The situation is unsatisfactory for the Engineering faculty who can not count on students entering their classes with the proper tools, for many of the Science faculty who are forced to rush through, or skim over, a packed syllabus, and for the students themselves.

We are asking our students to learn more in less time than we did a decade ago. But our students are not notably brighter, and they are certainly not better prepared in science and mathematics. We don't seem to be very much brighter either, and, although computer-aided learning boosts our teaching capabilities somewhat, our students are not meeting the standards of competence and confidence that we wish for them. We can not reach our pedagogical goals, in the allotted time, via the current path. Since we do not wish to change the goals, and the time is fixed by competitive pressures, we must change the path.

The classical pedagogical method involves the development of conceptual structures, rooted in classical mechanics and electromagnetics, over a several-year sequence of courses. With the luxury of what only in retrospect seems to be a rather leisurely pace, there was ample time to develop the particular sorts of examples that were believed to be of motivating interest to engineering students and to introduce the analytic techniques that would prove useful in a more application-oriented environment. The main objectives were to have the students achieve the insight that there are a relatively small number of fundamental scientific laws that undergird all physical interactions, and that reliance on such laws was an important method in the understanding and analysis of complex systems.

This historically-based technique assumed that such insight could best be achieved by the detailed development of examples in several widely dispersed areas. Given sufficient time, this method works, especially for those students with sufficient patience and talent. We made strenuous efforts to maintain this technique as the available teaching time diminished. To achieve this, some topics have been discarded and others are taught very much more quickly than they used to be. Material notoriously difficult to master in two semesters is now taught in one, and a shorter semester at that. Even the best of teaching cannot make up the difference; what was once difficult has now become practically impossible. There is simply not enough time to think, there is only time to do.

The structure and content of our current curriculum developed by the accretion of small changes. However, both the external world and our internal constraints have, by now, changed significantly and our relatively unstructured evolutionary change has not served us well. The external world demands a broader comprehension while the new academic calendar provides significantly less formal classroom time for its development. As a result, neither teaching nor learning is taking place as efficiently or enjoyably as desirable. We want our students to stand on the proverbial shoulders of the proverbial giants, but we no longer have the luxury of asking them to follow in every footstep. In a somewhat homelier simile, what we have to do is cut to the chase.

The goal of the science core is the understanding of the different physical manifestations of energy storage, transfer and dissipation, and of the laws, particularly the conservation laws, controlling these phenomena. It is also important to understand, as early as possible in the curriculum, the fundamental attributes of physical "things," rigid bodies, elastic bodies, fluids, and gases. The fundamental insights of quantum mechanics and the complex interactions of physical and analytic chemistry are also important components of the scientific core. But it is not necessary that all of these be taught in the freshman or even sophomore year.

We suggest that it is better, in the available time, to aim directly at the goal in the first year. The follow-on engineering courses could rely more strongly on the student's understanding of fundamental concepts and, therefore, could more confidently develop the explicit analytical techniques required for their particular areas.

We propose that the School of Engineering replace the present Institute Requirement with two new two-semester subjects, to be taken by all engineering undergraduates. These new subjects, *Unified Science A* and *Unified Science B*, to be described below, will differ from our current offerings in that they will stress the major integrating concepts, and use the need to develop specific application as motivation for develop-

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ment of analytical (specifically including computer-based) skills.

We propose that the new four semester science course be taken by all engineering undergraduates. The first two semesters, *Unified Science A*, are to be completed in the freshman year. It is expected, therefore, that all departments will be able to take advantage of the content of *Unified Science A* in their departmental sophomore year curriculum. *Unified Science B* can be taken at any time during the students' undergraduate tenure; the object here, of course, is to allow maximum flexibility for departmental scheduling.

The proposed course consists of the following one-year sequences:

Unified Science A:
CONSERVATION LAWS AND THEIR CONSEQUENCES

- Newtonian mechanics
- electricity and magnetism
- properties of matter

Unified Science B:
STRUCTURES AND INTERACTIONS

- quantum mechanics
- solids, fluids, gases, plasmas
- physical chemistry

It is essential to understand that it is not intended that these courses be a simple repackaging of the existing courses nominally covering the same topics. What is intended is that both the content and method of teaching emphasize at all times the particular integrating concepts suggested by their titles. A particularly noteworthy future of this scheme is that *Unified Science A* and *Unified Science B* will both have a significantly more structured intellectual content than the portmanteau of courses now used to make up the Institute's science requirement. As a result, we suspect that the *Unified Science Courses* will be substantially more satisfying to teach and consequently more effectively learned by our students.

Undergraduate education at MIT is a tightly constrained system. Realizing the potential benefit of any substantial change is possible only if other portions of the curriculum are suitably reconfigured. We are aware of this and we have taken as guiding principle the wisdom of making the smallest possible change necessary to achieve a given goal and the realization that important changes can only be instituted with the agreement and active participation of many members of the Institute family. More parochially, we are cognizant of the fact that the engineering curriculum is under particularly heavy stress. The changes suggested here, will have minimal impact on either the time or the scheduling flexibility now available to the engineering departments for the disciplinary portions of the curriculum.

The keystone of this proposal is the demonstration that *Unified Science* is a worthwhile course, that it is intellectually and pedagogically sound, and that it (particularly *Unified Science A*) will make the teaching of the discipline-oriented subjects more efficient than at present. There are many complex issues of content and implementation to be resolved, but we believe that the time has come for MIT to take the lead once again in defining the structure of engineering education.

There are many features of the proposed *Unified Science* curriculum that, if taken advantage of by the engineering faculty, can significantly improve the effectiveness of the discipline-oriented courses. In particular, we claim that the engineering school will come to rely on the content of the *Unified Science* course, particularly *Unified Science A*, far more strongly than is now the case. This will result in quantifiable gains in teaching efficiency and significantly stronger "cross cultural" interactions.

Teaching will be more efficient because all engineering students will have a common education in the fundamental conservation laws and some idea of their application to specific systems. Teaching of specific techniques will probably have lower priority than at present. Instructors of discipline-oriented courses may use that common core in developing application-oriented techniques. At present, almost every second-year course proceeds by restating the fundamentals and then redeveloping the techniques, because both aspects were inadequately mastered in the allotted time. The proposed benefit devolves from both improved focus and time efficiency.

The material covered in *Unified Science B* is not presently relied upon by the engineering school because not all students have covered this material at any given stage of their program and because individual departments (Chemical Engineering, for example) require a much more discipline-oriented model than would be appropriate in any so-called distribution course. We see no reason why *Unified Science B* could not be taken at any time in a student's program. This freedom obviates conflict in the sophomore year when some departments begin a very carefully scheduled departmental program.✣

TEACH TALK

How Am I Doing? Opportunities To Correct Your Course Mid-Term

Miriam Rosalyn Diamond

It's mid-semester. You've launched your class, navigated your way through half the course content, half of the problem sets, and the midterm. You wonder if you are reaching your students, and whether the means used to convey material have been successful. You know students will provide evaluations at the end of the semester, but that's too late to give you direction for this term. Don't despair! You can get feedback *now* on how the class is progressing and what you can do to get it on the best track.

Mid-term feedback provides a compass. You can use it to discern where the course is going and paths you may pursue to improve your teaching during the semester. Each group of students has its own expectations, needs and personality. Instructional techniques that were on-target with one cohort may falter with another. Checking in at mid-term can keep you informed about how well you're responding to students' needs; whether you're presenting material at the right pace; how clearly you're describing concepts and methods; your proficiency in evaluating student progress; and the extent to which you are keeping students interested and stimulated. At the same time your students are able to understand how you made pedagogic decisions and the way their peers feel about the course.

There are several methods available for mid-term assessment. Each has advantages and limitations. These techniques are not mutually exclusive; each may be combined with other options to attain a more complete picture. The following is a list of the most commonly-used options to help keep your subject afloat:

1) Devise or use a brief *form* to get written comments from students. These are best administered during (not after) the usual class meeting time, and should take no longer than 15 minutes to complete. Surveys can follow the Course Evaluation Guide end-of-term format. Or you may choose to ask a few general questions ("What aspects of the course are most helpful in facilitating your learning? Least helpful? What suggestions do you have that would improve your learning in this class?"). The questionnaires can refer to the details of your class (i.e., listing each aspect of the course, asking how that aspect facilitates learning and how it can be improved to increase the students' knowledge of the subject matter). You can also ask for summaries of key concepts the students feel they have mastered so far, what they are expecting to cover during the remainder of the sessions, and the advice they would give to students considering taking the class in the future. Although numerical data are easiest to tabulate, short essay questions may reveal more qualitative – and useful – information.

When analyzing and synthesizing this material, look for discrepancies between what you expected students to say and the actual reviews, as well as discernible patterns of responses and suggested modifications that can be made while the course is in session.

Don't forget to summarize findings in class and engage the students in a brief discussion. This allows them to clarify points, and for you to communicate modifications you plan to implement as a result of this exercise. Diversity in responses may reflect different experiences along gender or ethnic lines, background levels and learning approaches. Although this information is not available from the forms, you may discern such trends when processing results with the class. It also empowers the students to know that they have been listened to, and helps them appreciate the complexity of pedagogic decision-making by learning about the variety of opinions among their classmates.

(A warning: Asking students to give verbal feedback during individual meetings or class time – in place of an anonymous written survey – can yield misleading data. Not all students speak up or are willing to say something that appears to go against what they perceive as popular opinion. This practice can also make students feel uncomfortable; often they are concerned about making honest statements without fear of repercussion.)

The advantage of this format is that the students themselves give reactions to the overall course structure, as well as pedagogic style. The main disadvantage is that information received can be contradictory**,** so it may not always be clear how to proceed**.**

2) Have your class *videotaped* and reviewed with a Teaching Resource Network (TRN) representative and/or a faculty mentor. (You can arrange this by calling x3-7603 and scheduling a taping

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Opportunities To Correct Your Course Mid-Term

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session.) This allows you to see yourself in action, and experience the class from the perspective of a student. In addition, you can get suggestions from an expert.

Videotaping is a powerful means to focus on one class session and emphasizes presentation technique. Overall course structure, assignments, evaluation of student progress, and other out-of-class experiences may not be addressed through this medium.

3) Ask an accomplished faculty member or TRN representative to *observe* a class meeting in person and provide concrete feedback. This process takes into account not only presentation style, but includes interactions in the classroom and general atmosphere. It is important that your consultant be an expert instructor with an understanding of the range of options available for conducting a class. You should meet prior to the observation session to review the course syllabus, goals, and any specific areas on which you would like suggestions. Consider in what format their comments would be most useful. An evaluation instrument – with a checklist of major factors to consider – can help focus the observation. Alternately, you may decide that a narrative account would be more useful.

During the class meeting, introduce the observer to students. Clarify that s/he is there to help the instructor, not to evaluate the students' performance. Within a week after the observed session, the consultant should meet with you to discuss what they saw. This conversation should be just that – a dialogue and problem-solving session. The observer can encourage you to think through choices made and whether you considered alternate means of addressing the same goals.

Asking students to give verbal feedback during individual meetings or class time – in place of an anonymous written survey – can yield misleading data. Not all students speak up or are willing to say something that appears to go against what they perceive as popular opinion.

The data resulting from observation focuses on your instructional methods and effectiveness, as well as overall classroom atmosphere and interaction with students. It can situate the class in the context of your syllabus. However, it may not emphasize the general course structure or out-of-classroom aspects, such as assignments and examinations.

4) Participate in *group meetings* with peers. Through these, you may gain support, feedback, and ideas for expanding your repertoire. Critical events and decisions in teaching can be identified and processed as they occur throughout the semester. Participants are free to share frustrations and triumphs, learn how common particular incidents and concerns are, and discover new techniques that peers have found useful. Mentoring relationships between more accomplished faculty and new instructors can develop. At the same time, discussions are likely to focus on topics the participants choose to present/ emphasize, and may not provide opportunity to recognize all of your strengths and need areas.

5) Engage in *self-evaluation/ assessment*, through which you reflect on your teaching; goals, methods, and how you measure outcomes (by whether students stay awake? ask questions? performance on tests and homework? attendance?). Examine how the course is going, based on those outcomes. In evaluating yourself, remember to validate areas of competence, as well as room for growth. Devise a plan to improve skills that warrant attention. Also consider what you feel the students value about the course.

Examination of key incidents and interactions in the course can provide the stimulus for analysis, as well. Identify and learn from the challenges and mistakes you have faced. You may choose to keep a log, or periodically take an inventory check.

This method allows for self-evaluation and goal-setting. It also gives an opportunity to reflect on the entire course thus far, not merely a single class meeting. Yet, used by itself, this method does not provide important objective information.

As the semester progresses, it is helpful to chart the effectiveness of your class – and your instructional methods. Are you closing in on your original goals? Through the use and combination of student feedback forms, videotaping, observation, discussion among colleagues and self-evaluation, you can re-navigate and improve aspects of your teaching while the course is current.✣

[You can reach our Teach Talk guest columnist, Miriam Diamond, by e-mail at diamondm@mit.edu.]

TILT and the Role of MIT in K-12 Education

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On the other hand, MIT's institutional involvement has been sporadic and low-keyed. K-12 education and teacher education have not been considered to be MIT functions. There are no incentives for faculty to make these tasks a part of their professional careers, though MIT has encouraged and sometimes found support for those who chose to undertake particular projects in education.

Over the last 40 years, MIT's most conspicuous contribution to K-12 education was Professor Jerrold Zacharias' PSSC High School Physics Program, funded by NSF as a part of a broad effort to meet the Soviet Sputnik challenge by improving the quality of mathematics and science instruction in U.S. schools (1956-1960). The objective was to create and distribute a better physics curriculum (as SMSG was to do for mathematics, the chemical bond program for chemistry and BSCS for biology). As the PSSC program grew in scope (e.g., to train teachers in the use of the new materials and to develop materials for lower grades) it was spun off from MIT and has continued as an independent corporation (EDC in Newton, Massachusetts) presumably because such a large K-12 education program did not belong at MIT.

In retrospect, the attempt (at MIT and elsewhere) to improve science and mathematics education across the nation by involving leading academics in the construction of excellent curriculum materials was a failure. It did strengthen science teaching in some of the better (or more affluent) districts, but it was not accepted by administrators or teachers in the long run and has had little effect on the quality of science and mathematics teaching on a nationwide scale.

When some U.S. industries – automobile and consumer electronics for example – lost world market share to Japanese and other foreign competitors in the early 1980s, the public and the federal government assigned some of the blame, again, to defects in American public education (see "A Nation at Risk" - 1983) and another movement to demand educational reform began. It is still underway.

Again, MIT responded to the crisis and created the Council for Primary and Secondary Education chaired by Professor R.L. Latanision and included a broadly representative group of some 30 faculty, staff, and students (1990). The Council was asked to define what role MIT could best play in improving K-12 education, particularly in mathematics, science, and technology, and for the next five years received funds from the Institute to support any worthy pilot programs to carry out its role.

The Council reached consensus that MIT would be most effective in working with teachers – in educating new teachers, providing professional development for practicing teachers, and seeking ways to improve the systemic context in which teachers taught. Indeed, it rejected the notion that better curriculum taught by the present teaching staffs under prevailing conditions would achieve much progress.

On a broad scale, the K-12 education system is a complex system including administrators, teachers, students, parents, taxpayers, and suppliers acting out their roles in a fairly stiff institutional, fiscal, and cultural context. Proposed changes therefore need to be evaluated by considering their consequences on the entire system.

On a personal scale, the process of educating a young person involves diverse personal interactions between learner and teacher. Simply conveying logically structured information will not do the job. Teachers need to understand the dynamic process by which a particular youngster learns to grasp and eventually master a scientific relationship and discovers why and how such mastery is worth achieving.

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As a result, the Council sponsored three initiatives. The first was a program of one year internships or sabbaticals for a few (four to six) selected teachers from the greater Boston area. This program was discontinued after three years because it never became clear what the teachers were expected to learn or do at MIT and their role when they returned to their schools and classrooms was not defined.

The second enterprise supported by the Council was a program to educate

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TILT and the Role of MIT in K-12 Education

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and certify (in partnership with Wellesley College) a number of MIT students to become high school science teachers. This led to the development of an MIT education minor, administered through the department of Urban Studies and Planning. It also led to a continuing program, joint with several sister institutions (Harvard, Wheelock, U. Mass Boston, and the Boston and Cambridge Public Schools) and funded by NSF to understand (and get student teachers to understand) how children and teenagers perceive and learn to understand natural phenomena. That program is described by its leader, Professor Jeanne Bamberger and her collaborators in *The MIT Faculty Newsletter*, Vol. VIII No. 3 (March/April 1996).

Photo: L. Barry Hetherington

The third program, which is the focus of this article, looks at learning and teaching in a school as a system. Called The Institute for Learning and Teaching (TILT) it examines how helpful change can be brought about in a school. The two themes of TILT are emphasis on the open-ended study of large societal-technical systems and deliberate reliance on teamwork among teachers and students to carry out such a study. The pursuit of those objectives then requires a number of systemic changes in the operation of the school (or school district).

Focus on a large societal-technical system (often an urban system such as water supply and treatment or mass transit – sometimes a commercial system such as air transport) allows the student to bring to the table some knowledge or at least acquaintance with the subject, and more importantly, faces student and teacher alike with a situation rather than a discipline; a variety of learning styles are appropriate; a range of disciplinary inputs are required and several approaches or answers are acceptable. But to recast education in these terms requires changes in how the school is operated and how student learning is evaluated.

To stimulate a school staff to try this new mode of teaching, TILT invites teams consisting of five teachers of different disciplines, one administrator and one lay member of the school community (parent, local business person, academic, etc.) to spend time in a workshop in July at MIT with the TILT staff, and adult and UROP facilitators. The purpose is for the participants to learn to work as a team, then to carry out a project related to a large societal-technical system, and finally to reach consensus on a plan to convey what they learned to colleagues in their district and to specify the systemic changes needed to introduce the TILT model there. During the following school year, the TILT staff is ready with help and advice as requested. At the end of the year, the local team organizes a workshop for their colleagues. Collaboration between TILT and school teams often extends well beyond one year.

TILT has organized such programs for the last five years (1992-1996) and hosted 30 teams from urban, suburban, and rural school systems including over 200 participants, supported by some MIT seed money, several local and national private foundations, several federal and state agencies, several generous MIT alumni, and by the participating school systems themselves. The program was described in *The MIT Faculty Newsletter*, Vol. VII No. 2 (Nov./Dec. 1994).

We are now in a position (as we were not yet in 1994) to make a preliminary assessment of the systemic impact of TILT on the schools and the school systems which have participated in the program for several years.

Several systemic interactions appear to be important: over goal setting, resource allocation (including staff) and school autonomy between a central administration and a school; over teacher acculturation and community participation in school affairs in a given school district; and over what actually happens in the school building and the classroom.

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TILT does not address (except indirectly) the issues of overall system management (including the role of teachers' unions) or the ideological and political controversies which arise in some systems, but provides a frame to deal with change in single schools.

The TILT model looks at learning and teaching as primarily a social interaction and focuses on improving it by teacher training, by restructuring the curriculum to require interaction among teachers, and by shaping the learning situation into a collaboration of teacher and student. In that sense, it complements Professor Bamberger's emphasis on the way in which an individual (teacher or student) gets to understand a particular proposition.

Several generalizations are possible. TILT has not been effective in large urban systems or in individual schools in large cities, with the possible exception of the Harlem Choir Academy in New York City, which has special autonomous status and continuing financial support from Citibank. TILT has also had limited impact on systems with a low resource base, especially if their power structure is suspicious of changes advocated by an outside entity such as MIT.

The most fruitful partnerships grow with systems in which the school administration is committed to work with TILT; resources are found to extend the partnership beyond one year (from foundation, federal or state funds, or in a few cases as line items in the school budget); the TILT team stays together and works with other leadership groups (for example the business community or the PALMS leadership team [PALMS (Partnerships Advancing the Learning of Mathematics and Science) is the NSF-funded "State Systemic Initiative" for Massachusetts] or faculty from a local university or community college).

A wide range of changes have been introduced by school systems who have sent teams to TILT. Some emphasized close relationships with their business communities, including guidelines for student employment and for some participation of local entrepreneurs in teaching (e.g., Sutton, Massachusetts and Middlebury, Vermont). Others developed multidisciplinary courses designed to prepare their students for employment in specific fields (e.g., a course in the history and sociology of disease and the fundamentals of health science at Lowell Regional Vocational High School and Middlesex Community College). Yet others created a fund within the school to support technical mini-projects and reward the most interesting ones (Salem High School with Salem College).

TILT has not been effective in large urban systems or in individual schools in large cities....TILT has also had limited impact on systems with a low resource base, especially if their power structure is suspicious of changes advocated by an outside entity such as MIT.

I want to describe in greater detail the results of the activity of four TILT teams, which appear to have far-reaching systemic consequences. The New Bedford team (class of 1995) with an additional years' support from the "Goals 2000" program and PALMS, organized a broad leadership team combining the PALMS team, representatives from local business, and "not for profits." They organized team activities at all the elementary schools to which parents were invited. The enlarged leadership group then drafted a mission statement for their school system, focused on water as a dominant resource and focus of city life, and when the TILT team leader was appointed assistant superintendent for curriculum, they undertook the construction of a full elementary school curriculum based on fish and pisciculture, which was coordinated with a program at New Bedford Regional Vocational High School, to raise, cook, and distribute talapia fish on a large regional scale.

Whittier Regional Vocational High School, which serves 11 school districts in the Haverhill area of Northeastern Massachusetts, sent a team to TILT in 1994. Upon returning home, the Whittier team trained most of their faculty colleagues in the TILT model over two summers. Its leader became assistant superintendent for curriculum and worked with substantial success to bring the trade-vocational part of the house together with the academic side – for example, bringing language arts teachers into carpentry class to teach the students how to write proposals for work. The Whittier faculty has become so familiar and comfortable with TILT that the 1997 summer workshop will be located there rather than at MIT.

The Massachusetts School to Work system sent TILT a team in 1995. It included three Community College faculty and staff and three high school teachers – recruited from six different cities and towns and meeting for the first time at MIT that July. These six strangers promptly bonded into a team which worked on an aircraft maintenance project. They still work together, largely by e-mail, to develop the very real connection between TILT and School to

(Continued on next page)

TILT and the Role of MIT in K-12 Education

Trilling, from preceding page

Work. As a result of their effort, supported by the School to Work system, Bristol Community College has held a well-attended TILT workshop and is looking to introduce interdisciplinary courses. TILT has been invited to present workshops at all 15 Massachusetts State Community Colleges this spring.

Ashtabula County is located on Lake Erie in the northeastern corner of Ohio. It is a largely agricultural area in which industry is just now developing. Its schools are administered by six districts coordinated by a County Superintendent of Schools and are linked by interactive TV. A division of Kent State University is located in the town of Ashtabula, which is the county seat. An MIT alumnus who owns and runs a chemical business in Ashtabula felt that TILT offered a way to renew the schools and organized funding to send two teams from two of the county districts to TILT in 1996, with a faculty member from Kent State University as one lay member. They are training their colleagues this spring; funding for teams from two additional Ashtabula districts is available for 1997 attendance of the TILT workshop at Whittier Vocational High School. Thereafter, with support as needed from the TILT staff, primary responsibility for the Ashtabula program will be in the hands of the local council and Kent State University.

Alan Dyson, the leader of the TILT design team, has been invited to demonstrate the TILT program at the University of Natal in Durban, South Africa as potentially most appropriate to train a new generation of teachers and to develop partnerships among schools and industry. The TILT design team is also negotiating with the Connecticut Department of Education, Southwest Connecticut State College, and a team of school superintendents to participate in the program design for a new magnet school in the Hartford area mandated by a recent federal court ruling.

It appears, therefore, that the TILT model for the professional development of teachers and the initiation of systemic change in schools and small school systems is effective and recognized to be such. But, as it has been administered for the last several years, it is also costly. To support a team for a year costs over $45,000, and it is now clear that this is substantially more than a school system (or even a foundation) is willing to invest. And the model is not easily replicated or extended to a large school system.

The TILT design team is testing a more concentrated TILT experience in 1997, in partnership with Whittier Regional Vocational High School. By doing team building exercises before attending the workshop in residence – reduced from three weeks to eight days – and by doing the implementation planning after the workshop, a team will be able to reduce its costs to between $10,000 and $15,000. The new model implies that a team doing a project on a large societal technical system together is the keystone of the TILT experience.

The TILT design team is also looking forward to local groups, mostly but not necessarily exclusively academic, taking responsibility for designing TILT-like programs in their areas. This is happening with Kent State University in Ashtabula County and with Whittier Regional Vocational High School in the Haverhill, Massachusetts area. It will be tried by the University of Washington and the Seattle schools and by Bristol Community College in the Fall River-New Bedford area.

The role of interactive electronic media in this process is not clear; how much depends critically on face-to-face interaction (e.g., mutual trust building) and what can be done electronically. Discussions with our colleagues at the Center for Advanced Educational Services (CAES) and experiments using the Ashtabula County Network should provide useful guidelines. Yet it is difficult, in spite of these positive signals, to attract much interest for participation by MIT faculty, except for limited guest appearances. Indeed, while K-12 education projects have supported many undergraduates through UROP and the Community Service Fund, they have provided few graduate students with doctoral thesis topics. Given the fact that a group or project enjoys long-run survival at MIT to the degree that it includes publishable research done by faculty with graduate students, the prospects for MIT involvement with actual schools and teachers in K-12 education are dim.

This need not be so. A number of activities relating to education are underway. The Sloan School looks at the modalities of training the skilled labor force needs due to rapidly evolving industry and at the economic and social cost of coping with inadequately prepared public school graduates. The Department of Urban Studies and Planning must account for the place of schools in the economics and the ecology of large cities. They both look at urban schools, as it were, from the outside of a black box.

At the same time, CAES and teams at the Media Laboratory look at the learning process and the new technologies which enhance it as one part of the inside of the box. In addition, Provost Moses has agreed to institutionalize the undergraduate minor in education in the Department of Urban Studies and Planning to the extent of providing one half-time equivalent faculty position in the MIT budget. Could MIT's expertise at identifying and dealing with systems be directed to strengthen the clinical component of the systemic study of public education?✣

Task Force on Student Life and Learning Appeals for Faculty Response

John Hansman and Robert Silbey

The Task Force on Student Life and Learning has been charged by President Vest to review the educational processes of the Institute and the interaction between student life and learning as MIT moves forward into the next century. During the initial phase of this effort, the Task Force is soliciting broad input to help identify the fundamental educational challenges and opportunities facing us now which will likely have long-term implications for MIT's educational mission.

The Task Force is particularly seeking to tap the wisdom of the faculty, who have a unique perspective and responsibility regarding the role and future of MIT. Recently, the Task Force circulated a questionnaire to the faculty with a series of questions to help stimulate input. The preliminary responses to the questionnaire have been extremely valuable and have provided much thoughtful input.

This note is an appeal to those of our colleagues who did not respond. The Task Force is acutely sensitive to the issues of faculty pace and pressure and we understand that many faculty members don't have much time for questionnaires. However, we know that most faculty members have deep thoughts on MIT's educational process and mission.

We would urge you to provide input to the Task Force in any way you can manage. If you would like an e-mail or paper version of the questionnaire, send a message to (traci@mit.edu). Alternatively, you canjust send thoughts or comments to the Task Force to 4-117 or (learning@mit.edu).✣

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Search Committee Seeks Input On Role of the Registrar

Kerry A. Emanuel

The search for a new MIT registrar affords an opportunity to reexamine the function of the Registrar's Office as MIT enters the twenty-first century. I chair a search committee appointed by Dean Rosalind Williams to find a replacement for David Wiley, who stepped down at the end of the spring semester, 1996. Professor J.D. Nyhart of the Sloan School of Management is acting registrar.

The appointment of a new registrar will be made in an environment of rapid change at MIT and elsewhere. Electronic communication, the evolving diversity of the MIT community, and new ways of integrating the Registrar's Office into the administrative structure of MIT combine to set new challenges for the Registrar's Office. The new registrar will have to deal with a spectrum of issues, such as whether to make it possible for individual faculty members to access aggregate information on student performance. This is an opportunity for the faculty to advise on how the Registrar's Office can best assist us in our educational mission.

The Committee actively seeks the views of the faculty on the role of the registrar at MIT. We welcome e-mail correspondence to committee members: myself (emanuel@texmex.mit.edu), Associate Dean Mary Enterline (mzenterl@mit.edu), Professor J. Dan Nyhart (jdnyhart@mit.edu), Professor Martin Schlecht (schlecht@mit.edu), and Professor James Snyder (millett@mit.edu).✣