

MASSACHUSETTS INSTITUTE OF TECHNOLOGY



# MIT in Transition

## Student Perspectives on MIT's Legacy Strengths, Emerging Challenges, and Future Directions

### Academics, Research, and Professional Development Briefing Paper

*of the*

### Student Advisory Board to MIT's 16<sup>th</sup> President

26 January 2005

This document is the first of three specialized documents prepared by members of the Student Advisory Board (SAB) for MIT's 16<sup>th</sup> President, Dr. Susan Hockfield. It is intended to support the January 28<sup>th</sup> luncheon to be held with the President. The remaining documents in this series, as well as input from open forum discussions and the luncheons, will culminate in a more comprehensive report by the SAB to the President.



## 1<sup>st</sup> Topic-Based Lunch Meeting: Academics, Research, and Professional Development

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“The mission of MIT is to advance knowledge and educate students in science, technology, and other areas of scholarship that will best serve the nation and the world in the 21st century.”

The role of MIT, first and foremost, is to generate knowledge through research, provide its students with an unparalleled scientific and engineering education, and to engender a will to serve and contribute to society. In the area of academics, research, and professional development, the following topics touch upon MIT’s ability to follow its mission:

1. **Admissions** – The notion of the typical MIT student, graduate or undergraduate, continues to evolve. How can the Institute continue to recruit the most promising students and reach an appropriate balance in its student body, both at the undergraduate and graduate level, and in terms of demographics and academic bent? In addition, how will MIT involve its currently enrolled students in the admissions process?
2. **Curriculum & Programs** – MIT students pride themselves on the intensity and dedication to their studies that the Institute demands. What roles should the Institute take in framing a series of opportunities for students to develop their academic selves to the utmost?
3. **Faculty Issues** – Faculty are the conduit of knowledge between classroom learning and actual “hands-on” research. How does the Institute assess and value faculty educational contributions in contrast with their research? How might we retain and reward those who shine as mentors and educators as well as researchers?
4. **Professional Development** – In order to succeed in its mission, MIT must develop leaders and entrepreneurs, as well as scientists and engineers. How can effective leadership programs be put in place and what lessons can be learned from our most exploratory departments and schools? How can career advising be augmented to better support those interested in non-academic pursuits?
5. **Research** – Mentoring and learning-by-doing experiences are the hallmarks of the MIT experience. How can we encourage higher levels of excellence through increased awareness of opportunities and better attention to the mentoring relationship?
6. **Resources** – The Institute simply cannot expect its creative output to be sustained without ongoing assessment of space allocations, size of support staff, and information sharing. How can we most effectively utilize our resources in order to meet the needs of an ever-growing institution?

# 1. Admissions

## **Creating our Student Body**

The process and criteria by which new members are invited into the MIT community play key roles in defining what it is as an Institute and the direction in which it would like to move. The quality and range of applicants increases with each incoming class. In order to maintain the level of prestige associated with the institute, new standards must be created and existing policies refined. With average test scores and GPAs rising throughout the country, MIT may wish to place more emphasis on personal attributes in order to distinguish exceptional students. Based on test scores alone, the quality of the MIT student body has been steadily improving over the past several years; however, it is evident in the classroom that some students are not well prepared for the level of academic rigor that is expected. It has been MIT's history to search for the hardworking techie, but there has been a recent shift to bring in more well-rounded students to create a more diverse and balanced student body. There is no clear-cut description of what the ideal MIT student should embody. It is clear, however, that while considering the various personal strengths that applicants may portray, MIT must not lower its overall admissions standards. An unqualified student, no matter how well-rounded, should not gain admittance simply for the diversity that he/she may bring to the student body.

## **Graduate Admissions**

The decentralized nature of the graduate admissions process and the lack of a central graduate school have both positive and negative ramifications. Locally, within departments, the additional flexibility allows for more aggressive and successful recruitment. On an institute-wide level, this same flexibility makes it difficult to meet diversity goals, control the size of the graduate student body, and regulate the effect of various policies on graduate student community life. Decisions are often determined on the basis of departmental finances rather than long-term strategy. As a result, smaller departments in which TA positions are scarce, or those departments that cannot easily get government or corporate sponsorship, often find themselves unable to grow in a manner that is in line with their long-term objectives.

Internal fellowships, such as the MIT's one-year Presidential Fellowship, offer tremendous support to incoming students and junior faculty. The Institute must maintain and augment these fellowship programs both in order to attract high caliber students and to assist junior faculty in building strong research programs that will garner future funding.

## **Cross-Cutting Diversity Efforts of the Institute**

Under President Vest's tenure, MIT has embraced initiatives to increase diversity among all levels of its population. On the whole, these efforts have been much applauded, though they have also resulted in a great deal of confusion. In particular, many do not understand MIT's policy regarding affirmative action. To alleviate the misconceptions and emotions associated with this topic, MIT must more effectively communicate its diversity goals to its own student population. An assessment of where we are, where we want to go, and how we plan to get there is potentially one way to start.

Many students believe the Institute has not yet reached a desired level of diversity, particularly at the graduate and faculty levels. In addition, it is unclear what diversity truly means from a practical standpoint. Recent decreases in international student applications and admissions are considered by most to be detrimental to student life and learning. MIT may therefore want to consider a more holistic definition of institutional diversity that goes beyond boundaries of race and gender.

While diversity is commonly accepted as an appropriate goal, MIT students concurrently believe very strongly in the meritocratic ideal. New programs and policies must not come at the expense of diluting the meritocracy that currently exists at the Institute.

## **Student Involvement**

At both the graduate and undergraduate levels, the role of currently enrolled students in the admissions process is generally minimal and inconsistent. Students have the recent experience of applying to MIT and thus can more easily relate to the point of view of new applicants. This may enable students to more effectively distinguish between points of embellishment and true character in an application. Moreover, they have a unique perspective in terms of judging talent. In order to truly engage students in the admissions process, the

chance to review applications must be accompanied by an ability to influence the final decision to accept or deny.

There is a vital community-building element to student involvement in the admissions process. Many students want the opportunity to shape their communities, and are willing to accept the associated responsibilities. Within graduate departments where student input concerning admissions is actively solicited, one can observe a much tighter knit graduate community.

## 2. Curriculum & Programs

*(Note that the Task Force on the Undergraduate Educational Commons is also charged with reviewing the undergraduate educational experience and will provide more specific input)*

### Acclimation Programs

Acclimating to the academic challenges of MIT is a difficult task for most freshmen. For this reason, MIT has a number of programs that seek to ease new students into their collegiate academic life while engaging their curiosity to explore new subjects. Examples include the freshman Pass/No Record grading system and the sophomore exploratory subjects.

The Pass/No Record system provides students with the opportunity to gauge the difficulty of an MIT course load and to adjust their expectations without the pressures of dealing with grades. Instead of panicking after a poor performance, a student can learn from his or her mistakes and has a semester to work towards improvement. Many students believe that this program is well devised to provide a better transition to the coursework of MIT. Some others, however, believe that it provides a disincentive for students to perform up to their full potential when they first arrive, leading to increased difficulties in the following semester once they are graded normally. MIT must continue to strive to enhance the transition process for incoming students to encourage them not only to adjust, but also to excel for the remainder of their academic career.

The curriculum at MIT must also nurture the difficult transition into an extremely intense environment beyond the first semester. Exploratory courses offer a chance for students to try something new without worrying about the implications of a negative grade on their transcript. This prompts students to challenge themselves with classes they might otherwise consider too difficult, allowing them to further develop their academic abilities. The Institute should consider offering upperclassmen the same exploratory option. This move would allow students more latitude and encourage them to take academic risks that might pay off in the long-run.

### Undergraduate Course Requirements

The idea that all MIT undergraduates should receive grounding in mathematics, science, laboratory work, and humanities is a core value of the Institute. This grounding comes largely in the form of General Institute Requirements (GIRs), which encompass a set of 17 subjects to be taken by all undergraduates that include everything from physics to anthropology. Though students generally agree that obtaining a breadth of knowledge is important, many believe that GIRs are not implemented as they should be.

Because they are required to take several courses unrelated to their chosen field of interest, students lose the opportunity and flexibility to explore their majors as they would like to do. MIT should carefully consider which classes truly represent the intersection of all majors, of all students, and of all types of knowledge. These common threads must tie students together academically, serving as a source of intellectual strength across the Institute. In addition, too much breadth of curriculum may come at the cost of quality, causing material to be simplified so that all students may comprehend it. Equilibrium between a reasonable breadth and true depth of knowledge must be reached.

With regards to implementation, many students believe that existing GIRs face tactical problems. For example, within the school of Humanities, Arts and Social Sciences (HASS) undergraduates are required to take three classes (called HASS-Ds) that fall into three of five different categories, as determined by a lottery. Students find this requirement too restrictive, the selection of classes too small, the lottery system too limiting, and agree that an effort to give students more of a choice would likely enhance appreciation of these subjects. In addition to the HASS-Ds, students must take two Communication Intensive (CI) courses within the HASS (plus two CI courses within their major). While students acknowledge the importance of communication skills, many believe the current structure of CI classes simply have added papers that do little to help them improve their communication skills. The emphasis should instead be placed on peer-review, smaller class sizes, and greater interaction with professors.

In addition to reexamining the existing structure, some students believe the Institute should consider ways in which new courses might be included in the GIRs. In particular, MIT is one of the few institutions that do not require all students to take a foreign language, and it has been suggested that putting such a requirement in place might help develop students who are able to become world leaders. Some have suggested the creation of required curriculum that relates to diversity, in order to enhance students' appreciation of other cultures.

However, others argue that such a GIR would face implementation difficulties and that the addition of such a requirement to students' already intense course load might actually promote disinterest or disdain for the topic altogether.

Outside of the GIRs, course requirements vary widely within specific majors. Some departments, such as computer science or chemical engineering, create rigid schedules for their students while others, such as biology or math, have few requirements giving their students an opportunity to explore. In general, students prefer flexibility in their program, and some are deterred from fields that are too rigid.

### **Intensity**

Although MIT students vociferously acknowledge the difficulty of their course loads, most students take much pride in the dogged intensity with which they pursue their challenging studies. Within the context of curriculum, the effect of intensity on the quality of learning must be evaluated. Intensity can prepare individuals for challenges posed later on in life; however, it can also come at the cost of true interest in a subject and may cause or aggravate mental health problems. Intensity in classes is sometimes created by posing difficult questions and conceptual ideas, while at other times is a product of the sheer volume of the material. MIT students are always up for a challenge, but sometimes the quantity of expectations is overwhelming. The Institute must remain vigilant in balancing quality with quantity, in order to steward students' intensity in the most productive way.

### **Accountability and Evaluation**

Thorough, regular academic reviews of all components of the curriculum are essential to continued excellence. For the most part, the curriculum currently in place is accepted without question. Concerns are often answered with arguments based on tradition or a broad scale of learning. However, without serious student and faculty input, the administration cannot gain a clear idea of whether or not its programs are effective. Greater attention must be paid to the review and evaluation of the curriculum, particularly from the students who take and help teach the courses. In addition, academic reviews should be more tightly integrated into decision-making processes.

### **3. Faculty Issues**

#### **Faculty Development & Student Education**

Faculty members at MIT appear to be selected and granted tenure primarily for their research abilities without adequate consideration for how well they convey ideas in an instructive and coherent manner in the classroom. Students believe there is a need to further improve the process of knowledge exchange in the classroom and develop metrics for evaluating the communication skills and educational techniques of professors. Given that not all students learn in the same way, professors must explore teaching styles that adapt to their students' needs. Departments must do a better job of evaluating professors, using objective methods that take student input into account. These evaluations must, in turn, be used to improve the student educational experience.

#### **Academic Advising**

Currently there is no established, rigorous system that provides undergraduate students with a comprehensive program for curricula development. Instead, students often use academic advisors as rubber stamps for program selections that have been achieved without professional guidance. This creates an interaction between a student and faculty member that will never reach its full potential. In order to solve this problem, the Institute needs to provide incentives and training for good mentoring and must encourage faculty to consider the individual needs of their advisees.

#### **Faculty Retention**

Faculty retention directly affects student education and life at MIT. The student experience is adversely affected when the Institute loses well respected professors to competing universities, as recent visible cases exemplify. The students who are mentored, and the graduate students who have to disrupt their lives, suffer from the vacuum that is left in the wake of a professor leaving. MIT must identify methods of retaining excellence at the faculty level.

#### **Faculty Diversity**

Many arguments are made concerning the need to increase faculty diversity. From the student perspective, one relevant argument that is often overlooked is that a truly diverse faculty would do much to dispel the perception that engineering, mathematics, and the sciences are white male fields of study. Underrepresented minorities and women, for example, rarely if ever have engineering and science professors that are from their race or gender, respectively. The student body on a whole would be able to identify with and better relate to a faculty that is more a reflection of itself.

## 4. Professional Development

### Leadership Programs

Leadership includes not only skills to be taught but a lifestyle to be embraced through experience. While this is recognized in some aspects of the MIT community, there are further opportunities to develop and expand *practical* leadership development programs. A more formalized, holistic process, linking leadership opportunities in community life and academics, might benefit not only MIT's students, but the community at large.

There exists the old adage that MIT graduates work under Harvard and Yale graduates. Whether this adage holds true or not doesn't matter, but the stigma that MIT does not create leaders in industry and/or politics is troublesome. In fact, some formal leadership opportunities do exist. On the undergraduate level, students can participate in the Freshman Leadership Program, which is a preorientation experience, and LeaderShape, which occurs once a year over IAP. Graduate students in the Sloan school are able to become engaged in the Sloan Leadership Center. Students who are able to participate in both the graduate and undergraduate programs speak highly of their experiences. Yet the opportunities remain very limited, and are insufficient to meet the need.

The majority of students develop their leadership skills primarily through their roles in living groups, student groups, and student government. The contributions of these extra-curricular activities to students' professional development must not be overlooked. At the same time, there is a desire among many students for more formalized methods of developing oneself as a leader that can go beyond the opportunities offered by extra-curricular activities. Perhaps it is time for the Institute to embrace as one of its central values the notion of creating leaders, not only in academia and research, but in all aspects of life.

### Non-technical Development

There is concern, particularly among undergraduate students, that the opportunities to expand their critical business "soft skills" such as managerial communication, effective presentations, etc. are limited. A formal integration into the GIRs may help to increase students develop these important skills, but must be done appropriately.

Communication requirements have been established across the curriculum, but they do not seem to be accomplishing their goal. Most students recognize the need for developing their communication skills, but the relevance of these skills to a student's line of study needs to be clearly delineated. More opportunities for development of communication skills outside of the classroom would also serve as a great supplement to communication requirements in the curriculum.

### Career Advising

Many graduate students feel that there is an insufficient focus on career advising for non-academic pursuits, and some believe that the faculty overall do not respect non-academia career pursuits. While there are some formal resources available through the MIT Careers Office, there is a lack of consistency across individual departments in this area. There exists a need for more formal programs that encourage one-on-one career advising, with links to alumni, and a greater willingness to nurture students with non tenure-track aspirations.

### Alumni Engagement

MIT alumni represent a major untapped resource for career advising, mentoring, and job opportunities. Some MIT schools have been successful in engaging alumni, while others lack a real connection with even their most recent graduates. Many alumni are willing and able to offer support but do not do so because effective channels of communication with the Institute do not exist. To fill this gap, the Institute as a whole and individual departments need to create more effective mechanisms and facilitate more opportunities for communicating with their alumni base.



## 5. Research

### **Advisor / Advisee Relationships**

There are few things that play as significant of a role in a graduate student's experience than their relationship with their advisor, yet the Institute does not currently emphasize the importance of faculty mentorship. A positive advisor/advisee relationship enables students to make the most out of their experience, to learn important lessons for their personal and professional development, and to find support in times of difficulty. On the other hand, poor advising can often lead students to feel trapped, discouraged, unappreciated, and unable to reach their potential.

There are a variety of positive steps the Institute could take to address these issues. New faculty must be properly oriented and trained with regards to the importance of advising and mentoring, and the Institute must create clear expectations regarding their role in training students. Best practices, such as maintaining open and honest communication, should be emphasized. Faculty should be encouraged to make their expectations clear to new advisees, with regards to both work and funding, before the start of the student's research. The Institute must find ways to encourage faculty to consider the individual needs of their advisees and mentor them appropriately, rather than merely examining the volume of their output as a research assistant.

On the other side, the Institute must also guide graduate students on how to choose an advisor with whom they will work in enjoyable and productive manner. Students should understand what will be expected of them and what they can expect in return.

Similar to the case for effective teaching, the Institute should reflect its commitment to good advising in its tenure decisions. A professor acts in the roles of researcher, teacher, and advisor. Many graduate students feel that in order to truly consider merit in terms of a professor's advising capabilities, one must solicit input from the professor's past advisees.

### **Use of the Undergraduate Research Opportunities Program (UROP)**

UROP is one of the most unique and frequently highlighted aspects of MIT's undergraduate program. Conceptually, the program has substantial strengths: students get an opportunity to interact closely with faculty and develop professionally through hands-on experience in research labs where they begin to appreciate the applications of their academic studies. Students recognize the value and significance of these opportunities, which better prepare them for the rigors of the research environment as compared to students from our peer institutions.

As with any program, there is room for improvement with UROP. Greater attention needs to be placed on research mentorship and advising. Practices similar to what is needed in the arena of graduate advising (as discussed above), such as clearly communicating expectations at the start of the research, should be encouraged. In addition, while UROP offers significant opportunities, students often have difficulty finding positions unless they directly contact a faculty member. Through improved publicity, UROP can better match students with their fields of interest and allow them to have the best possible experience. Finally, it is important that MIT continue to evaluate the most effective way to distribute funding for the UROP program, including the basis upon which the central UROP office determines which applicants to fund.

### **Graduate Research Opportunities**

One of the primary limitations for graduate research opportunities is funding, particularly for graduate students in their first year. New students given funding to work on a particular project often feel that they lack flexibility in their research, and those interested in working with junior faculty face increased difficulties in finding funding. Depending upon the department, a new student may be given more or less opportunities to obtain funding through a teaching assistantship, which might give them additional time to search for an appropriate research group.

Students with fellowships generally have the most flexibility, though many external fellowships are unable to cover MIT's large tuition. The Institute should examine the ways in which policies regarding graduate funding might be altered to allow for increased flexibility, particularly among new students.

## 6. Resources

### **Space Investment & Planning**

MIT has undergone significant expansion and reorganization of its academic and research facilities in the past few years, and an assessment of how these changes have affected our research productivity and job satisfaction should be performed. Students are concerned about MIT's broad spectrum of investment in academic, research, and professional development geographical resources. Distribution and allocation of existing laboratory and academic resources is viewed as far from optimal in many locations. Also, the manner in which laboratory groups have been moved during the process of construction has been very disruptive to the work of both students and faculty, and more active engagement of affected groups should be made part of the planning process.

Planning and construction of "educational space," such as classrooms and study areas, could better consider the union between the design of a space and the impact it has on students' ability to learn. Moreover, increased formalization of access in reserving rooms, including places in the Student Center or Sloan study space, impedes casual study and is indicative of a systemic lack of study space.

### **Serendipitous Extracurricular Space**

Space for extracurricular activity can have a huge professional and community development role, providing an informal venue for interaction between students and faculty, visiting scholars, alumni practitioners, and the entrepreneurial community. Despite this, venues such as on-campus pubs and coffeehouses are currently underappreciated at the Institute. The Institute should consider how it could better promote and actively integrate its spaces as the educational and extracurricular resources that they are, encouraging increased student engagement and professional development opportunities.

### **Information Infrastructure**

The integrity of the computing network is crucial to many students' research productivity and academic study, as well as providing a medium for communication and community-building. MIT must remain at the forefront of network security, comprehensive coverage, and high bandwidth. Effort should be made to protect our network resources and support staff against imprudent cost-cutting measures and forced attrition. Furthermore, the quality and availability of library offerings in all fields, and the accessibility of these resources to the MIT Community, should match MIT's commitment to making its own resources available to the world. In an era of commercialized journal offerings, library acquisition budgets are under tremendous pressure. The library system should be offered the fiscal support it needs as well as the technical assistance necessary to increase its electronic holdings, and the Institute could take a leadership role in adopting a national stance that builds upon our strengths in OpenCourseWare in support of economically sustainable open knowledge exchange.

### **Academic Support Resources**

Cuts in research and facilities support staff, such as laboratory technical staff and custodial support, have impacted the ability of students and faculty to conduct research. In addition, student academic support resources, such as tutoring, are poorly marketed and/or are only made available after a "crisis," i.e. after a student has failed a major assignment or course. MIT should work to encourage a cultural shift that promotes student willingness to seek academic support before a crisis occurs.