The MIT Faculty Newsletter

Vol. IV No. 1 **September 1991**

Bridging Two World Views

Frank S. Jones

During the fall semester of 1989, while on sabbatical to Morehouse College in Atlanta, Georgia, I attended an orientation for freshmen in the Martin Luther King Jr. International Chapel, run by juniors and seniors. I was interested in understanding the Morehouse ethos; how in addition to Drs. King Sr. and Jr., it had produced such outstanding black leaders over the years, including those highly visible on the current national scene such as Secretary Sullivan of Health and Human Services; National Science Foundation President Walter Massey; and film director Spike Lee. I got a clue - and confirmation of childhood impressions - when the upperclassmen asked the freshmen to hold hands with their neighbors and then spoke to them of the traditions and spirit of the Morehouse family - past, present, and future - which included their sisters at Spelman College, a neighboring liberal arts college which has been historically oriented to African-American women.

Skip fast forward to a meeting last spring, publicly announced on the bulletin boards at MIT, and held at The New Words Bookstore in Cambridge. Some students were celebrating the publication of a new pamphlet: **Fight Back: An Underground Guide to Fighting Sexual Harassment**. The discussion which

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Editorial

Teaching: The Perennial Challenge

When in recent memory have so many important educational problems and opportunities had a claim on our attention? Undergraduate education is the focus of this first issue of the 1991-92 *Faculty Newsletter*, and its articles by no means exhaust the pertinent topics.

The scale of recent instances of cheating have raised the problem of academic integrity in the classroom, and we have the progress report of the Committee on Academic Responsibility on our desks (for an overview, see page 14). During this year we must consider whether we should redefine community values or responsibilities concerning conduct in the classroom and in the research

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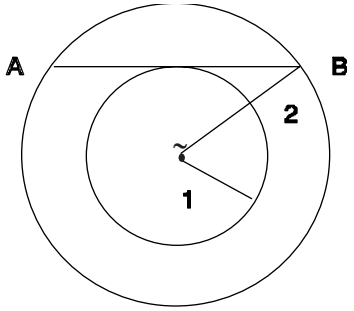
1) Two concentric circles are shown, having radii 1 and 2. Chord *AB* is tangent to the inner circle. How long is *AB*? [**For more, see page 7**.]



Some Reflections on Educational Innovation and Reform at MIT

A. P. French

For an institution whose fame and prestige rest primarily on its success in research, MIT has a surprisingly strong concern for the academic welfare of its undergraduate students. I am not thinking so much here of the upperclass students who have become associated with a particular department, and are of some professional interest to that department's faculty, but rather of the first- and second-year undergraduates who as yet have no such attachment or identity.

These students, who in principle are everybody's responsibility, can easily become nobody's responsibility. But, although MIT can be accused of arrogance in some ways, it is not complacent or indifferent with respect to its programs of general education, and it has a very creditable record of attempts to grapple with problems in this area.

Whenever such matters are discussed, people are likely to refer back to the famous Lewis Report, published in 1949. This report, prepared by a committee under the chairmanship of a distinguished professor of Chemical Engineering, and having as one of its members a future president of MIT, J. A. Stratton, was indeed a superb document, whose recommendations paved the way for a

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Editorial Board

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laboratory.

Competence with simple mathematical and physical skills appears to be problematic for some of our entering students. Two weeks ago the class of 1995 took the first diagnostic proficiency exam in math skills that has been offered in many years. A report of their performance is found in this issue (page 7). The skills our students bring with them on entrance reflect the state of technical education in the United States from kindergarten through the 12th grade, and a report on the progress of MIT's K-12 Committee appears on page 11.

The structural and procedural problems posed by the academic calendar and the proper role of our Independent Activities Period in January are under ongoing review, as part of a larger dialogue on the proper balance between general and professional education. This *Newsletter* contains a survey of the history, the problems, and the opportunities our unique IAP institution provides (page 15).

Last year the first issue of this *Newsletter* contained two thoughtful, incisive pieces on the problem of evaluating teaching performance within the tenure process, and the MIT Colloquium on Teaching and Research to be held in early October will address this issue among others (page 21). Last spring we concluded the debate on the introduction of a required subject in the life sciences; and the first pilot programs under its aegis are now underway. During the next year the HASS-D requirements will be reviewed, and the Science Distribution requirements are scheduled to be replaced by restricted electives in science and technology. Reports from committees charged with these concerns will be before us shortly and over the next few years.

The chair of the faculty in his column (page 5) draws attention to funding issues under negotiation or adjudication between MIT and the Federal government. These have the potential to change and constrain the scope of both undergraduate and graduate education at MIT. They merit our closest attention, and the administration deserves carefully reasoned advice and support from us as they contend with these pivotal problems.

Finally, the spirit of the teaching process lives in the sparks that sometimes pass between lecturer and learner. Two pieces in this *Newsletter* discuss the nurturing of sparks. One on the front page by a senior architect of the Science Core curriculum provides a retrospective view of physics teaching, focused on the prospects and opportunities for the future. The other (page 9) provides a synopsis of a recent experiment in lecture-style teaching that could lead to substantial improvements in student performance and depth of learning.

None of these issues is new to those who have been involved, even peripherally, with the reformulation of the undergraduate curriculum that has occupied the past five years. Those who have worked hard, both within committees and outside them, to draft, refine, explain, and promote the changes that we have adopted deserve our substantial vote of gratitude. The contributions of the Office of the Dean for Undergraduate Education are particularly noteworthy. These decisions, as well as the deliberations that preceded them, have been shepherded with an invaluable blend of patience, skill, and energy.

Although we have much to be proud of, certain elements of our educational decision-making process need scrutiny, for they do not always work as well as they might. Problems are most evident at the interface between departments and at the department level itself. A syllabus for an undergraduate subject can serve as an educational gyroscope, providing the continuity and stability that ensures consistent high quality teaching of essential material, despite changes in teaching staff. However, a syllabus that has outlived its time can provide a haven for lecturers who lack educational commitment, becoming a leaden weight that stifles innovation.

An outdated syllabus may be part of a larger curricular package that has outlived its relevance. Only infrequently can departments afford the time and effort required to redefine a curriculum, and faculty rightfully dread what can become a tedious pursuit of educational compromises in an overtly confrontational atmosphere of conflicting visions and priorities.

The educational decisions of departments and schools, moreover, tend to reflect their own local set of priorities. This can compound the work of Institute committees charged with curricular change, since these priorities almost always lie outside of the committee's mandate. The Institute's committee team may be rightfully excluded from the department's educational turf, but the committee is often thereby confined to procedural rather than substantive issues.

Of course it can be argued that our Institute committee process, by its focus on procedure, protocol, and requirements and by its ponderous pace, works properly and well. Rules work best when they are insensitive to local changes and are modified infrequently. It can equally well be argued that for at least some problems we might be better served by a more responsive mechanism. Perhaps it is time once again, with so many important

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educational issues at stake, to take a constructive look at aspects of the process we use for decision making. There are several potentially fertile directions for change.

Recently the CUP (Committee on the Undergraduate Program) has been involved with the planning, implementation, and evaluation of educational experiments. Those who write the rule books are thus directly involved with the experience of the classroom, increasing the likelihood that its subtle sparks can provide insights for the rulemakers. This appears to be a venturesome and important step in the right direction.

Conceivably more syllabi and curricula could be devised phoenix-like, with finite lifetimes and with built-in provisions for evaluation and redefinition. The full scope and potential of educational changes might be easier to assess if the single syllabus, with its undeniable administrative convenience and economy, could be replaced, at least occasionally, with parallel curricula that have contrasting styles and that are jointly evaluated. In addition, the struggle between turf and team might be rendered more constructive if better communication existed between the Institute committee structure and the schools and departments, and if committees had at least observer status during the redefinition of curricula.

In the classroom, educational excellence is often achieved by relentless, fastidious tuning of both content and process. Shifting the balance of committee authority to include some creative and innovative tuning of the rule book and the curriculum itself might be an interesting experiment.

A problem of a different kind is less conjectural and more easily remedied. After their appearance, a high percentage of our major committee reports are reversed, rejected, or outright ignored by the subsequent deliberative process. Although some committee members are able to see a constructive Hegelian process at work that justifies their effort, others come to view committee service as a gamble that all too frequently results in a futile waste of time and energy.

In some instances greater care in formulating the charges for committees may prevent some of these catastrophes, for it does seem that at times committees have been invented to solve problems of turf over which they have no authority. In other cases the committee itself is at fault. Committee insularity and failure to maintain contact with significant dissenting opinions in the community all too commonly sow the seeds for rejection. The forum provided by this *Newsletter* is one relatively new avenue for maintaining contact with community opinion, and others could be developed.

In our time, the reluctance of university faculties to engage in serious discussions of educational philosophy and institutional goals is reflected in the character of their committee reports, which all too frequently lack pith, bite, and focus. The continuing relevance of the Lewis report of 1949 mirrors a philosophical consensus that its authors clearly achieved. The world of 1991 is more complex, and MIT in its myriad strengths and diversities reflects that complexity. Yet we as faculty at MIT have explicitly accepted for our undergraduates a prestressed interaction between the conflicting demands of professional and general education. Perhaps that acceptance gives us a selective advantage in reestablishing a discourse on our common educational philosophy for the next century.

Editorial Committee

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Special Thanks

The Editorial Committee for this issue of the *Faculty Newsletter* offers heartfelt gratitude to Assistant Dean for Undergraduate Education Peggy Enders, for her participation in Committee meetings and her extensive effort in helping to prepare this issue of the *Newsletter*.

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Belated Thanks

The Editorial Committee of the June 1991 edition of the *Faculty Newsletter* gratefully acknowledges the research and writing contributions which Ms. Juliet Siler made to the editorial.

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Next Issue

The next issue of *The MIT Faculty Newsletter* will present follow-up discussion on the state of education at MIT, and offer continued commentary on the progress report of the Committee on Academic Responsibility.

Increased efforts at Federal and State levels to reduce opportunities for high school students to gain higher education is a topic that will be addressed, and there will be an analysis of Congressional motivation behind the recent attempts to reduce overhead payments at the university level.

We welcome contributions on these or any topic of interest to the MIT community - or even just a letter. Please address all material to: ***The MIT Faculty Newsletter*, 38-160;** by E-Mail at FNL@ZEISS.MIT.EDU; or to any member of the Editorial Board.

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MIT: Shaping The Future is a volume of essays by MIT faculty, edited by Kenneth R. Manning. The volume has been presented to President Vest, and will be published by the MIT Press. Planned publication date is October 1st, with a paperback cost of $9.95.

From The Faculty Chair

Participating In Change

J. Kim Vandiver

At a recent convocation for the entering freshmen Dean Lester Thurow told the students that they were "living in a time that will be prominent in the history books a thousand years from now." Because these are turbulent, uncertain times, they are filled with challenge and opportunity for us at MIT. Finding the time and the resources to engage in new activities while trying to keep current research and education programs alive is daunting. I am reminded of a once-popular poster in the engineering world which said "When you are up to your ass in alligators it's hard to remember that your initial objective was to drain the swamp." In today's complex world, you couldn't get past the environmental impact statement.

Even though the environment in which we carry out our teaching and research is complex and subject to constant change, we as faculty have a major stake in determining the educational mission and purpose of MIT. We will most certainly be called upon to make significant choices in the near future.

I am concerned that we have fallen into the habit of letting committees labor with little input from the faculty at large until "the problem set comes due" at the time of the faculty meeting vote. By then it is often too late to consider genuinely new proposals, and the outcome is at times uncertain. It is my personal preference and style to understand the range of proposals and passions on an issue prior to the day of the faculty meeting. It is my intention, therefore, to try to publicize issues as early as possible, and solicit comment and direct response to the appropriate person or committee. I see the *Faculty Newsletter* as a means of not only transmitting such information, but also stimulating dialogue on issues large and small. In the next few paragraphs I will describe some simple measures that I hope will encourage greater faculty and student participation in the process of reaching consensus.

One method of communication (with the permission of the editors) employs this *Newsletter*. From time to time there may be a highlighted box drawing attention to issues of current importance upon which I would like to hear faculty comments. (In this issue, the box is used to call your attention to the tentative agenda for the October Faculty Meeting.) Topics both large and small will be included. Since I intend to delegate some issues to fellow faculty, please respond in writing whenever possible. E-mail works well for me, (I can be reached at kimv@ athena.mit.edu), but you can also send your thoughts on paper to Room 5-222.

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For instance, we need faculty input regarding the selection of the next faculty chair. This may seem far off, but my successor must be selected next spring in order to serve one year as chair-elect prior to becoming chair in 1993. In the past, the following criteria were used to identify candidates: 1) a senior faculty member; 2) a person who has shown wide interest in the faculty governance system by participation in committees and other activities; 3) someone who has not had a recent significant position in the administration (department head or higher); and 4) a person with skills in mediation and negotiation. Write down your suggestions and forward them to me or to Professor Elias Gyftopoulos, chair of the Faculty Committee on Nominations, Room 24-109A.

We are also in need of improved mechanisms for gathering student input on many issues. I am experimenting this fall with a new undergraduate seminar which I am offering with Stephen Immerman, director of Special Services in the Office of the Senior Vice President. The subject is named "Participating in Change: Current Events at MIT," and will seek to involve a group of students in current issues of importance to them on a weekly basis. Topics might include the upcoming review of the calendar and the General Institute Requirements voted by the faculty last spring. Another important item is consideration of the issues and questions raised in the Freshman Housing Committee Report (a.k.a. the Potter Committee). I see weekly meetings with these students as an opportunity to inform myself of student views on vital issues.

I would like to take this opportunity to describe issues that are likely to require faculty attention this year. There is much

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Participating In Change

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concern about MIT's relations with the Federal government. Three specific topics come to mind: i) the outcome of negotiations with government agencies on indirect cost charges, ii) the threat to the MIT practice of charging the tuition of graduate assistants to the employee benefit pool (should this practice be eliminated, the cost per year of a research assistant could jump by 67%), and iii) the litigation stemming from the decision by MIT to fight the Justice Department's complaint regarding financial aid overlap meetings with sister institutions. These three subjects will be addressed by President Vest in his comments at the October 16th Faculty Meeting.

Scientific misconduct is another subject which influences our relationship with federal sponsors and further damages the image of scientific research in the public eye. The ongoing deliberations of the Committee on Academic Responsibility chaired by Professor Sheila Widnall will help to provide guidance on this issue. Being well-informed on these ethical issues is a responsibility that each of us must take very seriously.

Of long-term importance to each of us is the 1993 expiration of the mandatory retirement age. What will be the MIT response to this change in the law? Significant faculty input will be required to guide our future policies and practices in this sensitive area.

Of long-term importance to each of us is the 1993 expiration of the mandatory retirement age. What will be the MIT response to this change in the law? Significant faculty input will be required to guide our future policies and practices in this sensitive area.

I will close this article by putting out a call for comment on a relatively minor faculty governance issue and by alerting you to the tentative agenda for the October 16 Faculty Meeting.

Several faculty members have suggested that we consider abolishing the faculty meeting held in May a few days before graduation. It usually lasts about ten minutes and its sole purpose is to vote degrees. It is very difficult to establish a quorum, and exceptional degree cases are handled separately and individually through committees, the ODSA, and the Provost's Office. The proposed solution is to delegate the voting of degrees to a small group, perhaps consisting of the Officers of the Faculty, the President and the Provost. If you wish to comment on this proposal, please address your comments to Professor David Gordon Wilson (dgwilson@athena.mit.edu). He is a member of the Faculty Policy Committee and has agreed to shepherd this change through the necessary steps, culminating in an FPC discussion and possibly a faculty vote.

The tentative agenda for the October faculty meeting is printed below. See you there.

Faculty Meeting
October 16, 1991
Tentative Agenda

Comments by the President on Federal relations.

Report of the Faculty Study Group on International Relations
— Professor Eugene Skolnikoff.

Discussion of measures for preventing sexual harassment at MIT
— Associate Provost S. J. Keyser

Report of the Women's Subcommittee of the Equal Opportunity Committee
— Professor Herman Feshbach.

The Pre-Calculus Math Diagnostic

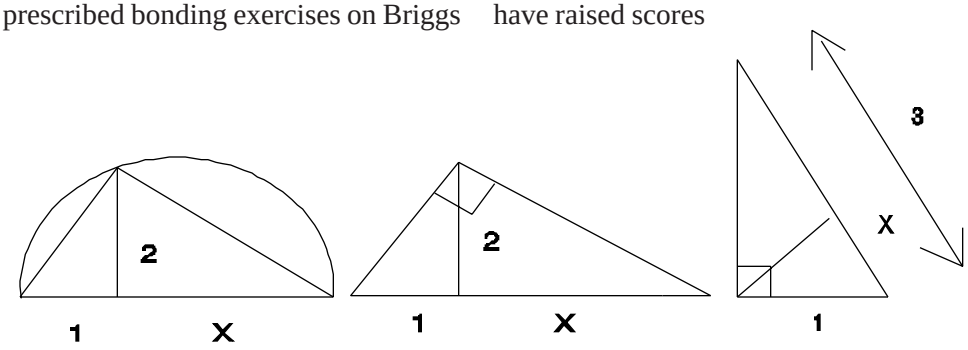
Arthur Mattuck

Whatever their differences, the engineers and scientists of MIT have long been agreed that the freshmen start out with little knowledge of high school mathematics and spend their first two years adding to this a general ignorance of calculus and differential equations. As documentation, diagnostic math tests have sometimes been given in the first 8.01 recitations; one was given in a core VI-I subject a few years ago. Results have been poor, as predicted. In the mid 1980's, a diagnostic test was offered by the Mathematics Department on a voluntary basis during R/O week, with four review modules (written by undergraduates as a summer project) available to help in brush-up. About 150 took the test each year, but they were not for the most part the ones who needed it.

This spring, largely in response to the high failure rate in 8.01 and 18.01 last year, Assistant Dean Peggy Enders of the Office of the Dean for Undergraduate Education (ODUE) led an effort to identify as early as possible those students likely to have trouble with the math in the core courses, and to give them timely help. Tony French (Physics) wrote a diagnostic exam which was sent out to all incoming freshmen during the summer as a practise test, and he and an undergraduate student, Adelaida Moranescu, prepared new versions of the review modules; a second, similar exam was then given to all freshmen at the beginning of R/O week before rush began.

Administrative anxiety made itself felt throughout the design process. Some in Admissions were afraid a stiff practise exam would change the normal summer melt to a meltdown; the R/O Committee prescribed bonding exercises on Briggs Field for the class on the eve of the exam.

The fall exam as it finally emerged consisted of 20 questions equally divided among algebra, geometry, trigonometry, and logarithms. The revision process was a steady watering-down. For example, the three successive versions of what started out as a standard exercise in similar triangles (*find x from the picture)* are given below.



The right angle implicit in the first version is made explicit in the second; the similarity of the triangles used is made easier in the last version, since they are now right triangles with a common angle.

The results of the exam should be taken with two grains of salt. Many students did not take the exam very seriously: two hours were available, but most were gone after a 50-minute hour, and some who did poorly left much earlier with little or no checking of their work. Also, the grading was Draconian: no partial credit. A random check suggests that giving partial credit would have raised scores considerably, perhaps by two or three questions, or even more for the sloppier students who seemed to sprinkle their (+) and (-) signs at random.

Bearing this in mind, about 5% of the students got perfect papers; the distribution was flat with about 9-10% in each category between 13 and 19 correct; below this was a somewhat irregular tail. About 10% got 8 correct or less. All students got their papers back from their freshman advisor, and those in need were urged to seek help. Besides the review modules, review sessions with a large staff of tutors were organized by the ODUE and scheduled on four successive nights of the first week of classes. Records are being kept on those who attend, with follow-up offered to those who need it.

So far so good; the cup runneth not over, but is at least half-full. It is also half-empty, if you look at results on individual problems. Scores in the algebra section were generally higher than in the other three parts; still, 300 students could not correctly express $(3.6 \times 10^{3})(200)/(6 \times 10^{-3})$ in scientific notation, and many of those who could, began by writing it as 3600 x 200/.006 and proceeding by conventional arithmetic.

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The Pre-Calculus Math Diagnostic

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25% missed the geometry problem described earlier, and a spot check showed that many of those who got it right did it clumsily by several applications of the Pythagorean theorem. How will they handle the force diagrams of elementary physics, which frequently call for the recognition of similar triangles?

45% could not give the ratio between the surface area and volume of a sphere.

35% could not correctly supply (with sign) both cos 45˚ and tan 120˚.

60% did not know the law of cosines well enough to find the third side of a triangle whose other two sides were 2 and 3 with a 60˚ included angle.

Three word problems were included, with low expectations and no disappointments. One gave the definition pH = - log [H^+], and asked for the difference in pH between two acids, if the hydrogen ions in acid 1 are at a concentration 25 times that in acid 2. Almost 50% missed it, mostly by placing the 25 with the wrong acid, or using it to multiply the pH instead of the concentration.

Why aren't students better prepared? Most likely, it is the general rush to teach calculus in high school, necessarily at the expense of pre-calculus mathematics. Students studied geometry three years ago, without much reinforcement since; less time is devoted to the numerology and algebra of functions like the sin and log, as they become little more than the names on buttons. The cheap new calculators which can graph equations and handle algebra are making waves, and Canute-calls for rolling back the curriculum to the emphasis on skills that prevailed in the first half of the century are likely to go unheeded.

In short, we live in interesting times. For now, and for us as teachers, it means reduced expectations, occasionally reminding the students of the facts and insisting they learn them, and avoiding the use of "just," as in "so now the problem has been reduced to just mathematics." *Caveat instructor recitationem.*

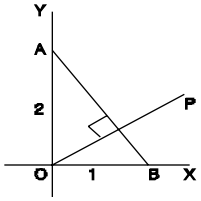
Examples from the Pre-Calculus Math Diagnostic

Algebra

2) Solve the system of simultaneous equations: $3x + y = 5$
$5x + 3y = 3.$

Geometry and Analytic Geometry

3) Find the *xy*-equation of line *OP*, which is perpendicular to the line segment *AB* shown.



Trigonometry

4) Using trigonometric identities, express cos 2x in terms of sin x.

Logarithms, Exponentials, Complex Numbers

5) The growth law for a colony of bacteria is: $N = N_o e^{3t}$, where t = time in hours, N = no. of bacteria at time t, e = base for natural logs. At the starting time t = 0, there are N_o bacteria. After how long a time will the colony be <u>three times as large</u>? (Give your answer in terms of natural logarithms, i.e., *ln* or $\log_e$.)

Answers? - Page 14

Optimizing Learning Through A New Teaching Approach

Daniel S. Kemp

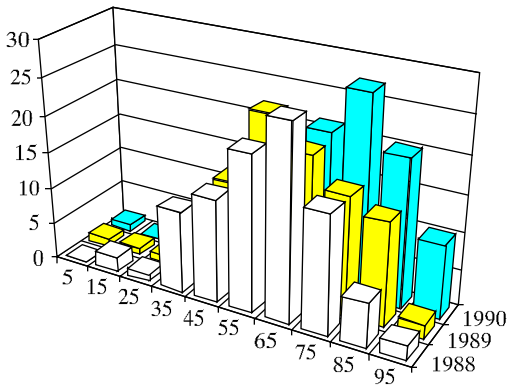
Student performance in MIT subjects has been a key issue throughout the educational self examination that has engaged us for the past five years: An appreciable fraction of our talented and carefully selected undergraduates apparently fail to measure up to their potential.

For the past three years I have taught chemistry 5.12, Introduction to Organic Chemistry, in the fall term to a group of 80-150 students. Although the overall content of the syllabus remained the same in these three years, other changes were made. Two additional hour exams were introduced to give an examination schedule consisting of a final and five hour exams. Moreover, without removing any material from the syllabus, a new topic was invented that was covered early in the term, and that reviewed and drilled the basic language concepts of organic chemistry, by exploring and developing their applications in a very general, in fact in a potentially open-ended context.

The results of the 5.12 teaching experiment to date have shown that student learning is not related in a simple manner to effort expended by the staff, but is highly sensitive to the context and topic order by which the content of the subject is presented. The level of performance of the 5.12 students as well as the depth of understanding they achieved, was found to depend strongly on relatively small differences in topic order and subject context.

Exam performance provided one measure of the increased proficiency shown by the students in the fall of 1990. The figure graphs results of final exam performances for the three years of the experiment for exams of comparable length, breadth, and degree of difficulty. Gratifyingly, the level of student comprehension provided a second measure. For the first time, the staff and the students themselves felt that a large percentage of the class in 1990 had grasped the underlying structure of the subject, rather than having merely memorized its superficial details. **[For a sampling of student comments, see boxes.]**

The curricular changes implemented in 1990 resulted from desperation after the failure of more routine methods. The teaching-learning experiences in 1988-89 were unsatisfactory in fundamental respects. Many students were unable to use the basic language elements of organic chemistry with necessary precision, and repeated exposure to that language in the normal contexts of the developing syllabus failed to correct the problem. Moreover, the second major topic of the standard syllabus in 1988-89, though



Performance on final exams in Chemistry 5.12. The graphs plot percentiles for exam scores and number of students. Curves in 1988 and 1989 are statistically indistinguishable; scores in 1990 show a significant increase in the 70-90th percentiles and a decrease in the 30-60th percentiles.

seemingly elementary from the perspective of the staff, had proven to be unusually difficult for many students and appeared to trigger high school-derived study mechanisms based on rote memorization. In 1990, this material appeared third in the syllabus sequence, following the newly-introduced special topic. Although performance with the traditional material remained unsatisfactory, the introduction of the new topic significantly changed the depth and style of learning of the class for the remainder of the term.

"Organic chemistry is usually taught by memorization and regurgitation of information. 5.12...is amazing in that he has taught us methods and basic ideas we can apply to the different topics throughout organic chemistry."

Of course it is not surprising to find that a straightforward topic causes serious difficulty for a significant fraction of the class. It is much more surprising that a conceptually more general, challenging, and subtle topic, properly presented, can serve as the focus for a substantially increased efficiency of learning.

The following are some educational observations that were used in devising the new curriculum for 5.12. They are stated generally, as principles that may provoke thought and perhaps find application within a much broader spectrum of subjects and teaching experiences throughout the Institute.

Rigidity in Learning Styles

If a given class has a sizeable percentage of students who are unable to continue with an analysis if one small logical detail is missing, then a topic early in the term that is not easily learned can define a negative mood that compromises

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Optimizing Learning Through A New Teaching Approach

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learning throughout the semester. I am not suggesting that one should spoon-feed the students by giving them only material they can like and digest; I am arguing the virtues, within the time frame of the subject, of matching the material initially presented to the initial learning stance and receptiveness of the class.

The Cost-Effective Study Habit

Homework is the place for which rigid stances of students have the largest impact, given that many students appear to dedicate a fixed fraction of time to each subject and to abandon hard problems that appear to be unlikely to yield solutions quickly. This study habit makes it very difficult to reach the class with problems that require an indeterminate period of frustrating thought, but then yield important insights suddenly. One solution to this problem is a carefully paced problem set that gradually develops the logical basis for the sudden insight by a series of thought-provoking exercises of lesser difficulty. One often has to seduce the student to the charm of hard puzzles and problems.

"The exams helped show where I needed extra work before we proceeded to a new topic which required the subjects I was fuzzy on."

Inclusive vs. Exclusive Modes of Attention

The instructor often imagines that transfer of information to students is **inclusive**, similar to a computer assimilating bits. In fact students often listen **exclusively**, filtering out what they believe to be irrelevant. The exclusive learning mode may result from the frequently voiced student perception that to survive one must be very selective about what work is actually done. If exclusive listening is occurring with an important course element, then it is necessary to find a new mechanism to teach that element.

Flaws in the Cognitive Apparatus

If one talks with class members midway through the term who are performing poorly, it is easy to find students who have worked nearly all of the subject material out for themselves but who lack one element that they cannot see. For these students, very large educational dividends can result from a modest investment in tutorial guidance.

The Framing of Learning Within Contexts

Beginners usually learn new skills embedded or framed within a context. For students at this stage, problems requiring the skill are solved by first explicitly or implicitly recognizing the frame and proceeding in a rather formal, rigid manner. Beginners can have considerable difficulty perceiving the range of application of a tool, which occurs only after adequate time for the full scope of applicability to become visible. The responsiveness of a class thus increases in steps or stages, and one needs to be able to judge when students are "ripe" for a less formal, more intellectual style of learning.

The Crisis Mentality

The immediacy of an hour exam in a particular subject often causes intense focusing of attention exclusively on that subject, which is then largely ignored in the periods between exams. This mentality hampers the instructor who wishes to stress intellectual continuity and generality, since it causes students to fall back on simple memorization as a tool and to suppress or reject previously learned information unless it has an obvious and immediate relevance to the crisis at hand. One remedy for this problem is to decrease the time between exams, thereby decreasing the weight and importance of individual exams and focusing importance on exams as learning tools.

Summary

This report is an abbreviated version of a much longer document that is currently available and that analyzes the results to date from the Chemistry 5.12 experiment in education. The parent document provides a description of the actual changes in course content, as well as more extensive data in support of the current conclusions.

"A test every other week made me stay on top of the material. I couldn't just exam for one week and then forget about 5.12 for 3 weeks. I really had to do a little every week which was very good since I am a big procrastinator."

The results to date imply that a careful matching of the curriculum of a subject taught in the underclass years to the initial intellectual stance of the average MIT student can result in dramatic improvements in class performance. Although the pertinence of these results to other subjects remains to be established, the central premise is highly encouraging and deserves further investigation. Given small curricular changes, our students may prove to be much brighter and abler than we have previously found them to be.

Report To The Faculty

The K-12 Committee Education: To Move A Nation

Ron Latanision

In the fall of 1990, then Dean of Engineering Gerry Wilson charged a committee (members included: Alan Brody, Naomi Chase, Dick Held, Greg Jackson, Al Lazarus, Larry Lidsky, Joel Moses, Ron Parker, J.J. Pitts, Judah Schwartz, Bob Silbey, Arthur Steinberg, and John Wilson), which I chaired, to explore the question of whether MIT should take on an institutional role in addressing the problems in K-12 (kindergarten through twelfth grade) education in the United States. Since that time I have asked that question of many in the MIT community - faculty, staff, alumni/ae - and others. In the extreme, first reactions have taken the following character: (1) "Absolutely not! What do we know about K-12 education?," and (2) "Yes, positively! Let's establish a K-12 school at MIT and show them how to teach!" These really are extreme reactions!

The Committee on K-12 Education has taken a more deliberate look at this question, meeting regularly from November of 1990 through June of 1991, at which point the Committee's Report **Education: To Move a Nation** was delivered to President Vest and Provost Wrighton for review and comment. While it would be premature for me to describe the recommendations of the report in detail now, I do want to let you know what the Committee has been thinking about and to editorialize a bit as well. We expect, in due course, to have much more to say about all of this.

Every concerned scientist and engineer is aware of the "crisis," alleged or real, in American K-12 education. America's educational system is not functioning as well as it must if the nation is to remain socially and economically healthy. The American public is technologically illiterate, relative to the populace of our trading partners. It is tempting to blame the schools and the teachers. My friend, Rustum Roy of Penn State, reminds me of the assessment of Paul Hurd, the former dean of education at Stanford. Hurd's view is that U.S. schools are not failing at what they were originally designed to do. Instead, society has changed its expectation of what schools are supposed to do, and in the process has passed on to schools what society, home, and community had done before. The impact of television, changed family structure, drug abuse, and new demographic patterns all originated in our society. It could be argued that the nation is failing and blaming the schools. In any case, it is clear that life and our shared values in the U.S. have changed during the past few decades and our educational system has not responded: some changes are necessary if our educational system is to serve contemporary and future Americans, particularly those underrepresented minority populations which are least well-served today.

The Committee believes that the educational system's problems are rooted in America's current cultural values, massive social and demographic changes, and global economic trends. A flood of reports and proposals during the past decade, beginning with **A Nation at Risk** and culminating more recently in the White House's **America 2000: An Educational Strategy,** have described these extraordinarily complex problems and have proposed a number of reforms: a longer school day, longer school year, national standardized tests, school choice, higher teacher pay, and others. The Committee believes, however, that no school reform will be successful without a corresponding change in the attitudes of students, parents, teachers - all Americans - towards the value of education and, particularly, science and math education, in our technologically intensive world. What is needed, in short, is a change in culture in order to move this nation into the next century. The Committee believes that education is the lever that may bring about such change.

America's educational system is not functioning as well as it must if the nation is to remain socially and economically healthy. The American public is technologically illiterate, relative to the populace of our trading partners.

Is it possible to change attitudes, to engage Americans in planning the nation's future, particularly with reference to the education of our youngsters - those who represent this nation's future? Does MIT have any special role to play in bringing about such change? The Committee believes it is important that MIT engage as an institution the problem of inadequate K-12 education,

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The K-12 Committee
Education: To Move A Nation

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particularly in the area of math and science education. We have recommended long- and short-term, Institute-wide initiatives in five areas that would serve the interests of MIT and the nation. We believe that these recommendations are consistent with MIT's mission in research and higher education, use our strengths in a realistic way, and do not represent an unmanageable obligation on a faculty and staff already working at capacity. It goes without saying that implementation of these recommendations must be financially feasible. Some of these recommendations are intended to have a national impact while others focus on our local community. Recommendations were constructed with the vision that MIT must ensure that every youth is served by its educational efforts - that the gap which separates most minorities from educational and employment opportunities be closed - and that special attention be given to our local Boston/ Cambridge communities in implementation. These include the following:

(a) The use of the media to bring about change in the public attitude regarding the need for educational achievement, particularly in science and math, by our youngsters: the issue here is not just exposure, but engagement, of the public. Many Americans were affected by the anti-smoking media campaign of the 1970's. The hook there was health. The hook in terms of education, we believe, is the personal standard of living of the typical American - the technology-based economy of the 21st century will not absorb workers who are not literate.

(b) The use of summer teacher institutes to focus on teacher enhancement and curriculum development. The object here would be to help teachers devise their own new curriculum materials through collaboration among teachers, university faculty, and industrial professionals.

A long-term research effort on K-12 math and science curriculum development is also envisioned.

(c) Evaluation of the potential of advanced technologies to amplify the efforts for revitalization of K-12 science and math education. While technology is not a "silver bullet" that, by itself, can reverse the declining quality of K-12 education, it can play a useful role, such as in the use of electronic networks to link teachers and schools with one another, with colleges and universities, and with other educational resources.

(d) A program for in-service teachers that will bring a culturally diverse group of teachers to MIT as fellows during the summer or on longer sabbaticals. Similarly, we believe that the Institute should encourage its students at all levels who express interest in K-12 teaching.

(e) The continued encouragement of a variety of individual efforts in K-12 education on the part of MIT faculty and staff. Our most publicly visible efforts to engage in K-12 education at the moment are the many outreach activities that have been initiated during the past few years at MIT by departments, centers, and other entities.

The Committee believes, however, that no school reform will be successful without a corresponding change in the attitudes of students, parents, teachers - all Americans - towards the value of education and, particularly, science and math education, in our technologically intensive world. What is needed, in short, is a change in culture in order to move this nation into the next century.

But, perhaps, the larger question is why should MIT engage in K-12 education? In fact, MIT has a long-standing concern for the education of young Americans. Jacob Bigelow, a prominent figure in MIT's founding, presented his Rumford Lectures to large Boston audiences that included not only college students, but the general public as well. Former MIT President Julius Stratton and Loretta Mannix point out in their new book, **Mind and Hand, MIT in the Nineteenth Century**, that Bigelow's **Elements of Technology** was an "elementary volume...composed for the instruction of the uninitiated, rather than for the perfection of adepts," and was intended to respond to an omission in the educational process at a time when the practical application of science was becoming ever more important. Stratton and Mannix emphasize that Bigelow made a special point of the relation between the sciences and the arts, "particularly those which involve applications of science, and which may be considered useful, by promoting the benefit of society...." As they observe "... the mind and the hand (*mens et manus*) became partners in a common cause." Bigelow sensed a need

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to reach the uninitiated - it is perhaps even more pressing today than in his era.

A more recent example of MIT's involvement with K-12 studies is the Physical Sciences Study Committee (PSSC), and its associated summer institutes, which began meeting in 1952 and was led initially by Jerrold R. Zacharias. PSSC physics changed the face of high school physics education in America. Even more recently, the MIT Commission on Industrial Productivity concluded in its 1989 report **Made in America** that "the failure to nurture our human resources" and the "neglect of the institutions that educate Americans" lie at the root of America's lagging productivity, and that "without major changes in the way schools and firms train workers...no amount of macroeconomic fine-tuning or technological innovation will be able to produce significantly improved economic performance and a rising standard of living." MIT has enormous credibility when it speaks about science and technology, and it can help make clear the connections between education and productively and, ultimately, between productivity and our standard of living. Our ability as a nation to influence world affairs is also likely to decline as our economic strength declines. A new report by the Committee on Economic Development (CED), a policy and advocacy group of 250 leading business executives, warns that "Unless we act swiftly and decisively to improve the way we invest in our most important resource, our nation's children, we are jeopardizing American's survival as a free and prosperous society and condemning much of a new generation to lives of poverty and despair."

If America's youngsters are its future, then their development and education must be the country's No. 1 priority. It is not clear that our collective national values reflect that priority. As just one example, we spend about 23% of the federal budget on the elderly (who vote) but less than 5% on children (who cannot vote!). Given that the clock is ticking for all of us, it is hard to argue that our elders should not be properly cared for. Perhaps some day, however, public officials will recognize that the education of our young must be treated as a long-term investment in the future of our communities, our states, and the nation. The same short-term mentality that has allowed U.S. industry to be eclipsed by that of our trading partners seems to pervade every aspect of American life. It strikes me that education is the lever that may change this aspect of our culture, but only if we allow it to do so.

MIT has tackled problems of national impact before. During World War II, MIT became involved in developing radar, a program with clear national implications. The nation was at war and its future was at stake. The same reasoning applies today: America's future as a viable, self-sustaining society in a global economy is no less at stake now. At the risk of exhibiting the lack of humility that others often attribute to MIT, the Committee believes MIT's position as the leading research university and its prominence in science and technology education are compelling reasons to take on the responsibility to move the nation with regards to K-12 education. I believe it is hard to argue that students, parents, and teachers should take seriously the educational crisis in K-12 if we don't. Science and math education in K-12 is not somebody else's problem - it's a shared responsibility and it is now time for MIT, as an institution, and as a citizen of Cambridge, of Massachusetts, and of the United States, to engage the problems of the K-12 system, particularly in the areas of math and science education.

If America's youngsters are its future, then their development and education must be the country's No. 1 priority. It is not clear that our collective national values reflect that priority....Perhaps some day, however, public officials will recognize that the education of our young must be treated as a long-term investment in the future of our communities, our states, and the nation.

"Education...has produced a vast population able to read but unable to distinguish what is worth reading."

G.M. Trevelyan

"Soap and education are not as sudden as a massacre, but they are more deadly in the long run."

Mark Twain

"Human history becomes more and more a race between education and catastrophe."

H.G. Wells

Progress Report

The Committee on Academic Responsibility

The Interim Progress Report of the Committee on Academic Responsibility was distributed to the faculty in mid-August. The Report also appears in the September 11 **Tech Talk**. Committee Chair Sheila Widnall shares the hope of the FNL Editorial Board that feedback from all constituencies will fill the next issue of *The MIT Faculty Newsletter*.

We summarize a few points from the report, with related questions:

Report: *Although science is today perceived by many as yet another special interest group whose access to public funds must be severely scrutinized, the fact remains that many of the problems faced by the world - overpopulation, mismanagement and depletion of resources, pollution - can only be solved through the disciplined application of human knowledge and reason.*

Question: Obviously, we must develop in ourselves and in our students forms of "knowledge and reason" beyond the strictly"scientific" or technical. Can our discussions be more specific than the last decade's discussions of "Humanities," "Context," etc.?

Report: *We hope that when this is understood, the public's esteem for science will be restored.*

Question: What can we contribute so the report (in its final version) will indeed help restore (and deserve) the public's esteem for science and for research institutions?

Report: *Because of the rapidity with which changes have taken place, much of the academic community is still unaware of the fundamentally altered environment in which the pursuit of science finds itself.*

Discussions with members of the MIT community about research standards and practices invariably began with the statement that such practices are quite field-dependent. While we believe this to be the case, we would like to...sharpen this assertion and give it content.

Question: To what extent are different perceptions field-dependent, to what extent are they due to varying awareness of change?

An Appendix to the Report lists specific guidelines in Data Management, Publication Practices, Peer Review, Training and Education.

Question: Are there structural conflicts? Are different guidelines needed for undergraduate and graduate training? For instance: does pressure to create employment for the financial aid/work-study component conflict with the goal of minimizing involvement of students in activities that do not provide meaningful educational experiences? Is the injunction against "fragmentary publication of the results of a scientific investigation or the multiple publication of the same or similar data" in conflict with the page limit policies of journals and proceedings volumes? Does the proliferation of specialized journals force scholars, especially those whose work is cross-disciplinary, to publish overlapping papers in journals that reach different audiences?

The above excerpts and questions are offered as a starting point to comments and commentary about the Interim Progress Report of the Committee on Academic Responsibility. We encourage responses from all members of the MIT community. Please send material to: ***The MIT Faculty Newsletter*, 38-160;** E-Mail at FNL@ZEISS. MIT.EDU; or to any member of the Editorial Board.

In addition, any member of the Committee on Academic Responsibility would welcome your comments.

Committee on Academic Responsibility

Richard Mulligan
WHITEHD 367
X8-5161
Biology, Associate Professor

Jerry Friedman
24-512
X3-7585
Physics, William A. Coolidge Professor, Institute Professor

Morris Halle
20D-219
X3-3221
Linguistics and Philosophy, Institute Professor

Gerald Wogan
16-333
X3-3188
Division of Toxicology, Director, Professor

Sheila Widnall - Chair
33-218
X3-7486
Abby Mauze Rockefeller Professor of Aeronautics and Astronautics

Committee E-Mail Address:
VALUES@MIT.EDU.

"To make your children *capable of honesty* is the beginning of education."

John Ruskin

Answers

1) $AB = 2\sqrt{3}$
2) X = 3; Y = -4
3) $Y = \frac{1}{2}X$
4) $1 - 2\sin^2 X$
5) $t = \frac{1}{3}\ln 3$

What's *Right* With IAP?

Linn Hobbs and Travis Merritt

Independent Activities Period was created in 1970 as the response to a charge by the provost to a Committee on the Academic Calendar, chaired by Professor Jim Munkres, to consider creating "a period without classes...between New Year's Day and the beginning of the second semester...to be used by faculty and students as they desired." In proposing the plan to the faculty, the Committee on Educational Policy stated that "the purpose of the independent study period would be to provide a time for students to read and to study at a more leisurely pace than is possible during the regular semester, to get better acquainted with the faculty member assisting them, and a time during which they would be free from the pressure of homework, quizzes and grades. Its purpose is *not* to give everyone a chance to pick up a few more units of academic credit."

The name originally suggested, Independent Studies Period, was amended to Independent Activities Period from the floor of the faculty meeting at which it was adopted. The Munkres Calendar Committee listed a dozen ways in which such a period might be utilized, and notably included, as a final objective, "providing opportunities for flexibility in learning and teaching styles." The opportunities, objectives, and concerns for IAP in 1970 are strikingly similar to those of 1991-92, a year when the idea of calendar reform is once again being bandied about.

Every four years since IAP was confirmed as a permanent fixture in the MIT calendar, the IAP Policy Committee has reviewed the January period. Activity leaders have been polled and participation statistics monitored each year since its inception. Extensive student and faculty surveys were conducted in 1977, 1985, 1988, and 1990. Department and sections heads have been interviewed, most comprehensively in 1990-91 (by us). What have we learned from and about IAP in these intervening 22 years?

"Everything Under the Sun"

First of all, IAP remains a unique and pioneering program which has attracted national attention and focus. While over a hundred universities since 1960 have instituted long mid-year breaks, study periods and even intersession periods and other variants of a 4-1-4 calendar, no institution's program is now or has been as comprehensive or ambitious as MIT's. The number of IAP activities rose almost monotonically from 1970 to 1985, leveling out at between 600 and 700 over the last half decade in what by any measure amounts to a true educational cornucopia.

The number of IAP activities rose almost monotonically from 1970 to 1985, leveling out at between 600 and 700 over the last half decade....

Just as anyone can come to the table at this feast, so too can anyone do the cooking. IAP draws from all segments of our community - research, support, technical and maintenance staffs, as well as students and faculty. Many of the more imaginative activities are initiated by students, and the experience of organizing and teaching material to which they bring individual enthusiasms provides a unique learning experience for them. A surprising number of activities are organized by graduate students who, although understandably using IAP to burrow into their thesis research, nevertheless find time to share their creativity; they are a considerable resource which is otherwise under-utilized in this community. IAP brings us all together in a way possible at no other time of the year. People from every nook and cranny of this Institute can and do rub elbows.

Student and Faculty Participation

Students consistently view IAP as welcome relief from the structure and pressure of the regular academic terms and as offering opportunities for alternative educational experiences. Faculty response is mixed, though most faculty members make valuable use of the January break and 85% have favored retention of IAP in its present form in a 1985 poll; 88% of those offering credit-bearing activities in IAP 1991 say they would offer these subjects again. Although only a small minority of faculty members would do away with IAP altogether and increase the length of the fall and spring semesters, a larger group is concerned about the educational substance of what goes on over IAP and favors increased contact between faculty and students during the January period. In IAP '91, only 160 (25%) of the 650 *IAP Guide*-listed activities were faculty-led (up from 125 in 1990) and less than 30% of MIT faculty members participated in any way in these offerings. In 1974, the number of faculty-led *Guide* activities was 262 (51%), representing participation by 34% of faculty. Of course, many other faculty members supervise UROP research over IAP and attend IAP activities along with students.

Laboratories and Centers have historically made better use of IAP than Departments. In IAP '91, the largest proportion of activities (40%) was led by Institute staff members, rather than by

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What's *Right* With IAP?

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students or faculty, and this has been true for at least a decade. This does not mean necessarily, however, that IAP is dominated by non-academic elements at MIT. Many of these staff are teaching and research personnel, and the proportion of activities organized by "academic" people (faculty; students; research, teaching and library staff) last year was 57%. Nevertheless, many in the administration, and at least the last three IAP Policy Committee chairs, have favored increased academic seriousness in IAP. The two most recent student canvasses in 1988 and 1990 have shown substantial student demand for formal credit-bearing academic subjects taught by faculty.

Academic Pace and Pressure

Increasing the academic content of IAP need not increase the academic pressure on students (and faculty) or turn IAP into a compressed caricature of the fall and spring semesters, which has been a persistent fear starting with the first IAP Calendar Committee in 1969. Quite the contrary, we suggest such offerings can do much to relieve the pace and pressure, altogether too prevalent in the fall and spring semesters, by promoting increased scheduling flexibility and widening academic options. Problems of pace and pressure arise when students don't have enough time to study what they want to take or what others think they should take. IAP can help by offering students the option of a subject they want to or have to take in an environment with reduced competing demands. All that is needed is a reasonable safeguard to prevent compulsive MIT students from overloading. This exists currently in the form of a 12-unit limitation on credit, a ceiling which the COC and Registrar take very seriously indeed.

A case in point is the array of 12-unit intensive foreign language courses, offered in French, German, Russian, Spanish, and Japanese in IAP '91. Undergraduate students often aspire to foreign language proficiency but cannot find time, between Institute and departmental requirements, to fit in the introductory subject, let alone a three- or four-semester sequence. Taking the first-level subject during IAP enables almost any student to acquire at least two semesters of a language. (The follow-on subjects might in some cases be offered in IAP as well.) The intensive format is particularly conducive to language acquisition and provides an alternative learning mode. Similar arguments apply to teaching computer methods, a highly successful example of which (10.001, with 87 students registered) was offered by Chemical Engineering in IAP '91.

With the exception of departmental field and internship programs (which are obvious but exclusive candidates for intersession periods like IAP) and remedial versions of 8.01 and 18.01, no Institute or departmental *requirements* are currently slated for IAP; the prevailing philosophy has been that it is contrary to the spirit of IAP to *require* that any subject be taken in IAP. However, the *option* of fulfilling departmental requirements, in alternative formats or permutations, is well worth exploring. In order to utilize IAP more efficiently, Chemical Engineering has, for example, considered modularizing its sequences of 12-credit required subjects into permutable 6-unit modules which could be fit into IAP, to provide considerably more scheduling flexibility for their undergraduate majors and increased options for taking elective subjects within or even outside Engineering during the regular fall and spring semesters. It has been argued that at least the competition part of 2.70 could be scheduled into IAP. The popularity of such practical learning experiences in an IAP format has been amply demonstrated by the student-run "6.270" robot design competition in Electrical Engineering.

Departmental Involvement

In September 1990, (then) President Gray and Provost Deutch wrote to the school deans, admonishing departments to reestablish central faculty involvement in the educational content of IAP. Department heads were asked to assume line responsibility for administration of departmental IAP programs and to enjoin their faculties to create IAP credit-bearing subject offerings with alternative teaching and learning formats, to be listed in the *MIT Bulletin*. Although a direct response to the recommendations of the 1990 IAP Policy Committee, this directive addresses a perennial plea of every IAP review committee over the past two decades. Indeed, it was the resolution of the faculty in 1973 that "...faculty objectives during IAP are no different from those during the rest of the year [....] Every department should establish for IAP a pattern of operations which makes its faculty accessible to students on the widest and most varied possible basis consistent with maintaining normal levels of research and outside professional activity. Every department should try to achieve an equitable distribution of academic responsibilities among its faculty during the nine month period of each academic year, including IAP, and if inequities should arise, it should seek to correct them in succeeding years."

It is fair to say that, at least until September 1990, this faculty directive had met with little more than token response from departments, not because department heads were obstructive or department faculties unsympathetic, but because many departments are stretched in their teaching, and department heads have few *quids* to offer for the *quos* in the tight scheduling of undergraduate

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What's *Right* With IAP?

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requirements.

We suggest that IAP is an opportunity, rather than an added burden, which could provide needed flexibility to an academic structure grown inconveniently rigid. Most engineering departments and some science departments are hard-pressed to squeeze into four years the Institute requirements, department core and sub-specialty sequences required for a professional education, let alone the context subjects and other humanities offerings perceived by many to be indispensable for turning out societally-responsible leaders of technology. The coming introduction of biology into the Science Requirement core, however laudable, further restricts available choice, while five-year professional programs run up against tuition barriers.

But the answer cannot be to return the 17 days of IAP to the fall and spring semesters and try to cram in more. (We doubt that many faculty would simply spread out the existing workload into the enlarged semesters.) Although integrating the IAP period over four years of an undergraduate education amounts to about a semester, eliminating IAP would lengthen each term by at most about four contact hours in any subject. Shortening it would yield even smaller term increments, while reducing significantly the number of large-scale January offerings. Retaining it preserves a built-in vehicle for doing, in sensibly quantized units, what we can't find time for in the regular terms. If half the creativity likely to be expended in devising new calendars were channeled to devising new ways to make IAP fulfill its intrinsic potential, the perceived need for calendar reform would disappear.

Creditable Offerings and Credible Freedoms

The question is no longer one of concern about credit-grubbing. It is one of responsible use of a precious resource. No matter how much we revere learning for its own sake, credits are the coin of the realm for serious academic effort. We have created the monetary system; it is unfair to devalue the currency. Sixteen major credit-bearing offerings in IAP '91 turned away substantial numbers of students; two-thirds were oversubscribed within a week of the *Guide*'s appearance. The demand is genuine. It exceeds supply to an embarrassing extent. And the clientele are not just highly motivated students wanting to tack a few more scoreboard points onto their career totals; they are students eager to try sustained learning in a different framework and expecting recognition for it.

Problems of pace and pressure arise when students don't have enough time to study what they want to take or what others think they should take. IAP can help by offering students the option of a subject they want to or have to take in an environment with reduced competing demands.

Credit-bearing subjects rose 20% in IAP '91, and the roster of activities meeting ten or more times doubled. But, numbering only 70 or so (10% of the total activities), such offerings still have a long way to go before IAP is choked with them, as some seem to fear.

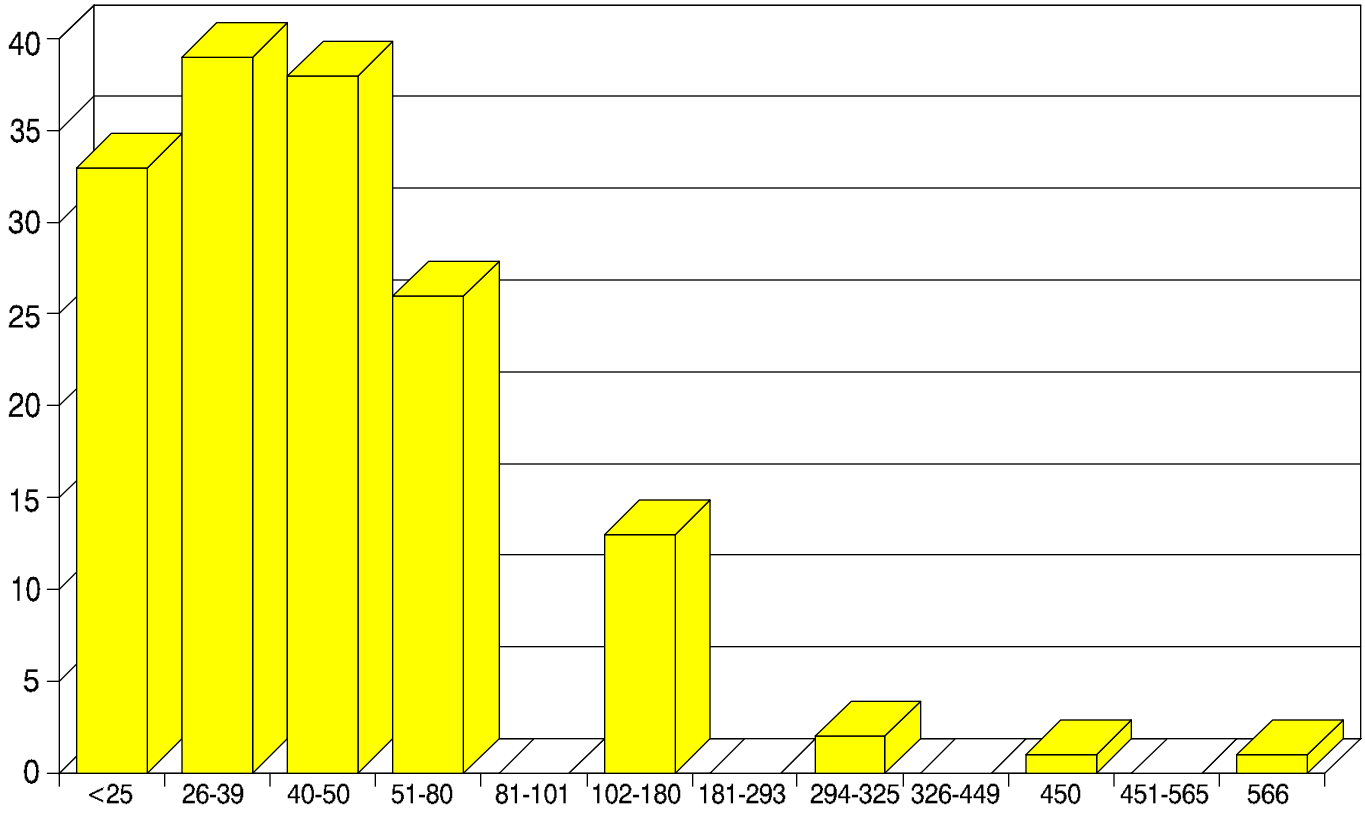
The *Guide* is as well-stocked as ever with hundreds of non-credit activities, many of them innovative, off-beat, and wild enough to gratify even the most extravagant appetite for cognitive recreation. Students are still at liberty to work for money during IAP, and many do. They are free to travel, or to stay at home to catch up on sleep. Athletics on campus run at full tilt and in astonishing variety. UROP can be tried on for size. Internship opportunities await. New public service fellowships beckon. Big Wheels can be dined with. The original free-wheeling spirit of IAP is not in jeopardy.

Still, the temper of this time is not the same as that of 1970, and MIT's January must continually adjust to new realities. For a while, students liked to justify IAP very much as one would justify a vacation period, almost exclusively as release and respite from the MIT pressure-cooker. This argument no longer suffices. Many (though by no means all) of today's students want actual study as part of their IAP experience, and we should provide opportunities for that as well as those for less intellectual doings. There is time for both. A single 6-unit or 9-unit IAP subject hardly locks anyone out of other activities. It's worth remembering, too, that study in the January regime is *necessarily* quite different, in rhythm and style, from its counterpart in fall or spring, and the difference is intrinsically refreshing if not relaxing. The prime criterion for any student's self-designed IAP program to meet is that it be arguably an integral part of his or her total educational experience at MIT. We should "require" no more and no less.

Over 1000 undergraduate students received grades and credit for some piece of activity during IAP '91. More than 3000 didn't. But upwards of 75% of **all** undergraduates were on campus for at least the last three weeks of the period, and the evidence shows that their energies were actively engaged. IAP may appear frivolous to some faculty, but a lot of students are serious about it. Our January is gaining, not losing, strength. We should keep our Independent Activities. Period.

M.I.T. Numbers

Classroom Space*



Room Size	Number of Rooms
25 & Under	33
26 - 39	39
40 - 50	38
51 - 80	26
81 - 101	0
102 - 180	13
181 - 293	0
294 - 325	2
326 - 449	0
450	1
451 - 565	0
566	1

*Classroom space under the jurisdiction of the Schedules Office. Individual departments maintain a variety of mostly seminar-sized rooms.

Source [and thanks]: MIT Schedules Office.

Renovation and Renewal: The Literature Curriculum at MIT

David Thorburn

In the past two or three years, as the national debate over multiculturalism, political correctness and the alleged breakdown of the canonical traditions of the old Humanism has grown louder, more polarized and uncivil, I have discovered increasing comfort and intellectual satisfaction from the curriculum in literary studies at MIT.

Conceived in the late 1970's in the aftermath of the political protest and curricular confusion that marked the era of the Vietnam War, the literature curriculum at the Institute has been a practical and an intellectual success whose contribution to our community has been underestimated or taken for granted. In fact, in my own (no doubt biased) view the literature curriculum has been one of the glories of undergraduate life at MIT over the past 15 years.

The low visibility of the literature program at MIT is not hard to understand: we are preeminently a scientific and technological environment and no undergraduate enrolls here intending to make literary study his or her primary work. Moreover, unlike their colleagues in engineering, the sciences and the social sciences, the humanists oversee no substantial graduate programs, and the whole culture of MIT tends, perhaps appropriately and in any case inevitably, to conceive such fields as literature and history - the core of what used to be called the liberal arts - as "soft" or peripheral. And of course this internal state of affairs is replicated in the larger world. I've lost count of how often I've heard this response from people who learned that I'm a Professor of Literature here: "Oh, really! I didn't know they taught literature at MIT." Yet as nearly all our undergraduates come to realize early in their careers at the Institute, literature has a central place at MIT - in an innovative curriculum notable for its stability, its intellectual coherence, and its commitment to diversity.

The curricular renovation undertaken by the literature faculty at MIT was simultaneously radical and conservative, responsive to powerful, legitimate complaints against the rigidity and narrowness of the old Humanist agenda but conscious as well of the enduring intellectual values embedded there.

The numbers alone tell a remarkable story. Over the past 15 years, annual enrollments have averaged more than 1100; in the last three academic years annual enrollments in literature subjects averaged more than 1200. More than eighty percent of MIT undergraduates take at least one literature subject before graduating. A significant and steadily increasing number of undergraduates choose to minor or to major in literature; as of June 1990, 42 students were registered for the minor program, 34 were majoring in literature. The literature concentration has long been one of the most popular in the School of Humanities and Social Sciences; since 1985 an average of 170 students have registered as concentrators each year.

In 1976 when the literature faculty embarked on a major renovation of its program, all subjects in literature were essentially introductory; there were no prerequisites and the only difference among courses was that some - a disproportionately large number - carried Humanities Distribution credit. Certain courses drew decent numbers, but it was virtually impossible to predict enrollments, and many subjects were scandalously undersubscribed.

One reason for this situation was that the literature program had become an essentially freelance operation, in which each professor was responsible for subjects in his/her specialty but without significant coordination with colleagues. A second reason was that the catalogue listed many subjects that were taught irregularly. Literary study at MIT had become amorphous and incoherent.

It's important to realize that these circumstances mirrored the condition of humanistic study at most American colleges and universities in the period following the turmoil and challenge to intellectual authority that characterized the late 1960's and early 1970's. The old "high culture" curriculum had come under fierce, and often ill-conceived attack; in response, requirements had been abandoned and traditional subjects had been deserted by students and by teachers.

The curricular renovation undertaken by the literature faculty at MIT was simultaneously radical and conservative, responsive to powerful, legitimate complaints against the rigidity and narrowness of the old Humanist agenda but conscious as well of the enduring intellectual values embedded there. The new curriculum aimed to reestablish the principle that literature was a body of

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Renovation and Renewal: The Literature Curriculum at MIT

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knowledge, offering a tiered or graduated set of subjects in which students who had mastered elementary skills could move on to more advanced subjects.

The new curriculum embraced an enlarged, more generous conception of literary study, incorporating such material as film, popular culture and writing by women and by ethnic or minority groups largely excluded under the old dispensation. But it did so in a moderate, inclusive spirit that continued to support and respect the aesthetic value and cultural importance of older traditional texts.

In a significant departure from the practice at many other universities, the literature curriculum did not segregate its non-canonical materials into separate categories or intellectual ghettos. Instead these texts were integrated or "mainstreamed" in a unified but diverse curriculum.

In the introductory tier, for instance, the survey of American literature now includes such things as slave narratives, neglected or newly recovered texts by women, African-Americans and native Americans along with traditional works by Emerson, Thoreau, Melville, Twain, Emily Dickinson. Other introductory subjects contain a similar mix of new and traditional materials.

In the intermediate tier of the curriculum, traditional subjects like "Romantic Poetry" or "Eighteenth-century Fiction" share space with courses devoted to "Women in Literature," "Popular Narrative," "American Television," and "American Voices," which treats a range of minority and non-canonical texts, including popular songs, folk tales, native American literature.

The advanced or seminar tier maintains a similar, controlled mixture of traditional and new authors and texts, and deals as well with theoretical approaches to literary and cultural interpretation.

In the introductory tier, for instance, the survey of American literature now includes such things as slave narratives, neglected or newly recovered texts by women, African-Americans and native Americans along with traditional works....The result of these and other changes is a curriculum that offers a far more diverse and stable range of offerings in literature than that available in most liberal arts colleges.

Certain operational principles, adopted when the new curriculum was introduced in 1977, have been as important to its success as the pluralist intellectual rationale that undergirds the program. To accommodate the majority of students for whom demanding requirements in science and technical fields have first priority, introductory subjects are offered every semester and in nearly every time slot. Nearly all literature subjects are offered every year, so as to allow concentrators and minors as much flexibility as possible in planning their programs.

The result of these and other changes is a curriculum that offers a far more diverse and stable range of offerings in literature than that available in most liberal arts colleges. Literature concentrators and minors at MIT can, for example, center their work on particular periods or genres or broad themes of the traditional sort, but they can also concentrate in such areas as popular culture, film, literature by women, ethnic and minority cultures.

And, perhaps most important in light of MIT's tradition of intellectual excellence, students who major or minor or concentrate in literature will nearly always be working with teachers who are nationally recognized experts in the materials under study - an advantage rarely available to undergraduates even in major liberal arts universities, where distinguished faculty have only minimal contact with non-specialist students.

This last, crucial virtue of the literature curriculum at MIT is a consequence of the fact that the renovation of literary studies here occurred during a time of internal change as momentous in some respects as the changes taking place in the outer culture. For during the 1970's the old Humanities Department at MIT - a catch-all space for historians, literary scholars, language teachers, philosophers, anthropologists, musicians, others - began to enlarge and to disperse into separate, autonomous units, whose expectations for promotion and tenure were measured by the standards already in place elsewhere at the Institute.

My own pride in the professional distinction of my literature colleagues and in the intellectual power, the rigor and diversity of our curriculum is unqualified. But I confess I do hope for the day when the program for literary studies at MIT will achieve the recognition it deserves: the day when outsiders, on learning that I'm a Professor of Literature, will respond (accurately, at last): "Oh, really! I've heard that literature at MIT is especially imaginative and exciting!"

A Presidential Colloquium on Teaching and Research

Travis Merritt and Lyna Wiggins

Anyone who regularly reads this *Newsletter* - or simply listens to the talk of colleagues - will be familiar with several recurrent themes in faculty opinion: alarm over changes in the research funding environment; concern about the seemingly inexorable multiplication of demands on our time; pride in MIT's hard-earned uniqueness as a science-centered research university committed to a distinctive brand of undergraduate education; a certain ambivalence toward the linkage between teaching and research; a persistent eagerness to quicken our classroom skills. On Wednesday, October 9, people from all walks of the Institute's academic life will come together to talk about the confluence of these and other issues in an MIT Colloquium capaciously titled "Teaching Within a Research University."

This Colloquium, initially conceived by the Inauguration Committee for Charles Vest, will be the concluding official event of his inaugural year. The specific topic was set as a challenge by President Vest as he works to build consensus about the shape of MIT's institutional mission for the future. It is in fact a topic that should draw us all into productive discourse, so that right questions may be framed, and their answers tentatively sought, in an ambitious collective act of self-definition.

Like earlier MIT Colloquia, this one will occur in two stages: convergence for a plenary session in Kresge Auditorium (4:00 to 5:30 PM), followed by dispersal into smaller discussion meetings, with food (6:00 to 8:00 PM). Since the practical implications of the topic this time are specific to particular disciplines, the dinner-discussions will be hosted by academic departments rather than by living groups. Each course will structure a meeting in its own way, though all will involve a mingling of faculty, research and administrative staff, graduate students, and undergraduates (freshmen will be allowed to choose among the various departmental sessions).

For the large Kresge gathering, the Colloquium Committee has devised an unusual format. A "mega-panel" of ten MIT people (administrators, faculty, staff, and students representing all five Schools), to be introduced by President Vest, will address this general Challenge Resolution:

"*MIT faculty are both teachers and researchers. At their best these two roles are mutually reinforcing, and their fusion uniquely strengthens the Institute as a place for learning. In practice, however, they sometimes fall out of balance or even into conflict. To enrich undergraduate and graduate education, MIT should find specific ways to make teaching and research more closely complementary in the professional lives of all faculty members.*"

The panelists will be probed and goaded to specificity (and brevity) by Michael S. Dukakis, former governor of Massachusetts, who will take the role of interlocutor. He will proactively elicit response to a range of relevant questions and sub-issues, including but not limited to these:

˜›˜››Should the criterion of balance between teaching and research apply to any academic department as a whole and/or to all individual faculty within it?

˜›What are the existing reciprocities between teaching and research, and how can they be extended/strengthened? Can we imagine (and implement) others?

A "mega-panel" of ten MIT people...will address this general Challenge Resolution: "MIT faculty are both teachers and researchers. At their best these two roles are mutually reinforcing, and their fusion uniquely strengthens the Institute as a place for learning. In practice, however, they sometimes fall out of balance or even into conflict. To enrich undergraduate and graduate education, MIT should find specific ways to make teaching and research more closely complementary in the professional lives of all faculty members."

˜How does the spirit of this resolution apply to MIT's many research laboratories and centers, where many non-tenure-line staff and graduate students join faculty in the educational enterprise?

˜Should peer review of teaching effectiveness be undertaken as systematically as peer review of research in promotion and tenure cases, and given equal weight in decisions? How?

˜UROP is maybe our strongest suit in teaching and research complementarity. How can we have more of it and encourage earlier involvement for undergraduates?

˜For many Institute faculty, teaching excellence means mainly lecture-hall performance. Do we need more attention to interactive teaching modes, discussion method, and the dynamics of learning in very small groups?

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A Presidential Colloquium on Teaching and Research

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˜Is it true that, for graduate students, research assistantships carry more prestige than teaching assistantships? If so, why? Should this value system change?

˜How can students - graduate and undergraduate alike - be given the most effective voice in the assessment and reward of good teaching?

˜The quest for research grant funding becomes increasingly arduous and time-consuming. How does this affect teaching quality, including personal accessibility of faculty to students? Should MIT re-adjust its expectations about how much of their own compensation faculty members should raise?

˜Do we have enough support services and instructional resources to help faculty members develop their teaching skills?

˜Do multiple educational demands on faculty time molest research efforts?

˜How do grant funding sources affect MIT's educational agenda and programs?

˜What's our working definition of a research university?

In closing, Provost Mark Wrighton will attempt to summarize the afternoon's proceedings.

In the interest of lending real substance to community-wide discussion of the Colloquium topic - and in the hope that practicable courses of action may emerge from it - the organizing Committee is soliciting focused opinion-pieces from the faculty and others. These will be gathered into a retrospective publication of record, which will also include a summary of the Kresge proceedings and notes derived from the various departmental discussions. If you'd like to contribute something succinct (no more than 750 words, please), try to get hard copy and disk to Donna Friedman, MIT Colloquium Committee, Room 7-104, by October 1, so that your views can be made available to the panelists and the interlocutor before the event itself.

Colloquium Participants

Introduction
President Charles M. Vest

Interlocutor
Governor Michael S. Dukakis

Panelists
Dean Robert J. Birgeneau
Yonald Chery, 6/G
Professor Woodie C. Flowers
Professor J. David Litster
Dean Joel Moses
Professor J. Mark Schuster
Colleen M. Schwingel, 15/4
Professor Robert J. Silbey
Professor Irene Tayler
Professor Jacquelyn C. Yanch

Summation
Provost Mark S. Wrighton

Authors

A. P. French is Professor of Physics.
Linn Hobbs is Professor of Material Science; IAP Policy Committee Chair.
Frank S. Jones is Professor of Urban Studies and Planning.
Daniel S. Kemp is Professor of Chemistry.
Ron Latanision is Professor of Materials Science and Engineering.
Arthur Mattuck is Professor of Mathematics.
Travis Merritt is Professor of Literature; Head UASO.
David Thorburn is Professor of Literature; Director, Cultural Studies Project.
J. Kim Vandiver is Professor of Ocean Engineering; Faculty Chair
Lyna Wiggins is Assistant Professor of Urban Studies and Planning.

Some Reflections on Educational Innovation and Reform at MIT

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major redesign of the core program, and whose eloquent articulation of MIT's educational goals has never been bettered. Almost every subsequent effort to modify or reform the core has used this report as a starting point. In this article, however, I should like to adopt a more personal approach, and speak from my own experience of educational reform at MIT since I first became introduced to it almost exactly 30 years ago.

The story, so far as I am concerned, begins with J. R. Zacharias, a professor of physics at MIT from 1946 until his retirement in 1970. He achieved fame in the late 1950's for leading a national effort to create a new high-school physics course, known as the PSSC (after the name of the committee - the Physical Science Study Committee - that guided it). Zacharias and his chief collaborator, Francis Friedman (another professor of physics here) decided to follow this up with a program to produce better basic science instruction at the university level. They formed what was first called the Science Teaching Center. Although its aims were to influence the teaching of science everywhere, MIT was the natural testing ground for its work, and one of its chief products was a radically different version of freshman physics. Initially (1963) this was taught just as a small option for about 50 students, but the next year (my first as a permanent member of the MIT faculty) it was enthroned as the only available version of freshman physics. It was given what was meant to be a very neutral title - "Physics: A New Introductory Course" - but our students, more alive to things than the unperceptive authors, seized upon its acronym, and from the very first week it was known as PANIC. In line with Zacharias's ambitions, this course tried to offer to all freshmen some acquaintance with "modern" physics - i.e., physics from 1895 to about 1930! - in addition to the 17th-century mechanics and 19th-century electricity that had been the almost exclusive topics of the previous standard offering. I mention this not so much for its own sake, but as a striking instance of MIT's openness to change in the educational arena. It was certainly not the only major change going on. At about the same time, I believe, Amar Bose and his colleagues in Electrical Engineering were creating a new version of the basic courses in their field, and I am sure that there were many others.

The next major highlight was the introduction of the UROP program in 1969. Inspired by Edwin Land's famous "Generation of Greatness" speech to the MIT community in 1957, and given some initial financial support by Land himself, this program has grown and flourished since its earliest days under the leadership and guidance of Margaret MacVicar.

In 1964, also, came the biggest single reorganization of MIT's core programs since the 1950's. Again the chief name was that of Jerrold Zacharias. As chairman of the Committee on Curriculum Content Planning - deliberately and facetiously designed, in this case, to have the acronym CCCP, with compliments to Lenin - Zacharias required his committee members to devote a full week of every month during a whole academic year to immersion in the core courses and curricula. The recommendations of his committee were instrumental in persuading the faculty to reduce the monolithic core programs from two years to one, and to replace the lock-step of the second year with such things as the Science Distribution, the Institute Laboratory Requirement, and a wide spectrum of offerings to satisfy the requirements in Humanities and Social Sciences. Even in the freshman year, there came into being a range of options in the mathematics and science subjects. Whether this was altogether a good thing has been a subject for debate ever since, but again it was testimony to MIT's readiness to experiment with educational reform.

The next major highlight was the introduction of the UROP program in 1969. Inspired by Edwin Land's famous "Generation of Greatness" speech to the MIT community in 1957, and given some initial financial support by Land himself, this program has grown and flourished since its earliest days under the leadership and guidance of Margaret MacVicar. It is now so well known, and so much a part of the educational fabric of MIT, that it certainly needs no comment from me. Many would say that it is the most important single innovation in undergraduate education that has ever taken place at MIT - to say nothing of the model it has provided to the many other institutions that have emulated it.

Although many individual innovations have happened since the 1960's, the greatest emphasis in recent years has probably been on the total educational experience, particularly for our beginning

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Some Reflections on Educational Innovation and Reform at MIT

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students. I will not try to contribute anything new to the seemingly interminable debate on the subject of "pace and pressure," but I would like to say a few words about one specific area in which I have been personally involved - namely, the Writing Requirement.

In an institution as heavily committed as MIT to the fields of science and engineering, it is easy to overlook or ignore the fact that, although the language of science is mathematics, plain English (or its equivalent in other cultures) is absolutely essential to its effective communication. Every practicing scientist or engineer knows that, and spends a substantial fraction of his or her professional life putting words to paper, or making oral presentations; yet, until recently, development of literacy in the normal sense in our students has been regarded as being for the most part the job of humanities instructors. Certainly there have been few rewards to students for good communication within the scientific and engineering subjects themselves, and few demands for them to demonstrate an ability to put their science into words. A typical examination in freshman physics, for example, requires nothing beyond an ability to write down and solve the appropriate equations (and even here there is usually no penalty for disorderly presentation so long as the final answer is right). I believe that the institution and general acceptance of a writing requirement at MIT is of enormous importance. In its present limited form it scarcely deserves to be written with a capital W, but it is a step in the right direction. I hope that, as time goes on, a substantial writing component will be incorporated throughout the teaching of science and engineering subjects at all levels. I recall the complaint of one student who said that, through lack of use, her writing ability deteriorated markedly during her years as an undergraduate here. But the other side of the coin is that a large fraction of our incoming students are seriously deficient in writing skills (I come to this fresh from inspection of this year's Freshman Essays!) and may coast until late in their undergraduate career before being asked to demonstrate the ability to generate a sizeable piece of correct and coherent prose.

The biggest challenge we have in designing our general courses is to identify those aspects of our discipline that will provide a useful and lasting piece of education for the non-specialist. I think we have a long way to go before we get away from giving introductory courses that are merely the first steps in a complete sequence of courses for science majors.

So much for specifics. But some of the most important aspects of our educational operation are in a different dimension. They concern such things as the qualitative character of the educational experience, and the faculty's awareness of what our students are like. And no effective reform or innovation can take place without taking these things into account. At the risk of inviting controversy, let me touch on such matters, recognizing that I am offering a strictly personal view.

The distinguished physicist Hermann Bondi once pointed out that the professional lifetime of a typical faculty member is on the order of 30 years; therefore, to replace him or her requires only an average of 1/30 student per year. In other words, an almost negligible fraction of the students we teach are going to step into our shoes, and most of them don't even want to. It is a mistake - but a mistake that we probably all fall into in our teaching - to act as if our students share all of our outlook, values, and interests. One of the reasons that I became a physicist is that I delight in solving tricky problems in classical mechanics. I can talk about such things with enthusiasm, and some students in the freshman class will respond in kind. But many more will feel that they are being asked to perform pointless gymnastics. (It is a somewhat different matter once students have chosen a major department and are becoming young professionals.) The biggest challenge we have in designing our general courses is to identify those aspects of our discipline that will provide a useful and lasting piece of education for the non-specialist. I think we have a long way to go before we get away from giving introductory courses that are merely the first steps in a complete sequence of courses for science majors.

I should like to comment, though with some hesitation, on a related aspect of the fact that most of our students are not potential professors. This is that, although the young people who are admitted to MIT are very bright, their interests may not be particularly scholarly, and they may not all be full of intellectual curiosity. Most of them will go out to become valuable members of society, and that is

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all we are entitled to ask. We should not feel disappointed if they do not resonate to our own enthusiasms, which they may regard (perhaps with some justice) as absurdly narrow. This, too, is something that needs to be taken into account as we design our instructional programs.

A third point, specifically with respect to students when they first come to us as freshmen, is that they are amazingly diverse in terms of academic background and intellectual (as well as social) maturity. Faculty who do not teach freshmen may be largely unaware of this, but those of us who work on the high school/college interface are constantly confronted with it. Although most of the students who enter MIT are indeed impressively competent and well prepared, it is important to recognize that an appreciable fraction of them may never have been exposed to rigorous academic discipline. The recent mathematics diagnostic, described in this *Newsletter* by Arthur Mattuck (see page 7), provided significant evidence for this fact. It is too easy to overestimate the preparedness of our new students, and the design of our introductory courses needs to be constantly reviewed to check whether there is a mismatch between what we would like to offer and what our students are capable of handling.

Let me close with some remarks about the qualitative aspects of the typical classroom experience for a freshman student in a core science subject. The first thing is that the experience is predominantly passive. I believe that this, in itself, detracts in a major way from its educational value. The second thing is that the typical student is juggling at least four subjects at the same time, transferring attention and effort from one to another under the pressure of homework deadlines, etc. The instructor, however, whose sole teaching responsibility is just one of those subjects, is very liable to overlook the fact that the students' academic lives are fragmented in this way. If we are serious about educational innovation and reform, we should try to find ways of addressing both of these situations. My colleague John King has in fact done this. A number of years ago he introduced the concept of "concentrated study," in which a student would, for example, do nothing but calculus for four weeks, followed by four weeks of physics and then four weeks of chemistry, totally immersed in each of these subjects in turn. (This has an advantage for the instructor too, who has to work phenomenally hard for four weeks but then has the rest of the semester free to pursue his or her own work!) The scheme was tried, but did not endure. (Perhaps it should be given another chance.)

But countering the passivity of the educational experience within a single subject is well within the bounds of practicality, as John King has demonstrated with his programs of take-home experiments in 8.01X and 8.02X. We still give lectures in these subjects, but it is quite possible to envisage a course that is based entirely on the hands-on activities. In a talk I gave a few years ago, I drew attention to the fact that the lecture, as a means of instruction, dated from the 12th century, and the printed book from the 15th. Shouldn't it be possible, as we approach the 21st century, to find means of instruction that are not based almost entirely on these archaic techniques? Not that I would dispense with them; their very survival is proof of their value. But I do believe that there is plenty of scope for major changes in the way we perform our teaching role - especially at the world's foremost institute of technology. (Yes, Athena, I know you are there, but you can't do everything!) And I hope that we never reach the point where we decide that our educational problems are solved. Only through constant re-examination and constant renewal will our teaching programs continue to be exciting and alive. We of the older generation enjoyed a particularly favorable climate for such activities. And without them, innovations tend to fade and disappear, and may have to be reinvented. (This is just what happened to freshman physics; after a few years the PANIC program was replaced by a traditional course. We have recently revived it, hopefully in an improved form, in the 8.01X/8.02X sequence.) My own chief concern, at this point, is that under today's conditions of ever-increasing pressure on our faculty members, there may be few (especially of the younger faculty) with the time and inclination to engage in true educational innovation, as distinct from performing a conscientious job in the teaching of existing courses. Perhaps the time is ripe for the appearance of another Jerrold Zacharias, possessed of his volcanic energy and entrepreneurial skill, and his gadfly ability to infuriate but also to inspire and to provoke far-reaching change.

In a talk I gave a few years ago, I drew attention to the fact that the lecture, as a means of instruction, dated from the 12th century, and the printed book from the 15th. Shouldn't it be possible, as we approach the 21st century, to find means of instruction that are not based almost entirely on these archaic techniques?

Bridging Two World Views

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followed the reception was funny and sad, exhilarating and depressing, overwhelmingly incisive as the women students - most of whom had been sexually harassed by professors - talked about turning their rage into the constructive task of publishing a pamphlet which would instruct other women on negotiating their way through MIT after they had been sexually harassed.

I recognize that these events are not symmetrical. They are helpful to me, however, in thinking about teaching at MIT. The event in Atlanta was at the center of the Morehouse ethos. The event in Cambridge was marginal to responsible and visionary entrepreneurship in one way - the corrupt behavior of some male faculty - and central in another - the young women students were exemplary social entrepreneurs!

Finally, nothing in these remarks should imply that events at Morehouse do not have a profound downside. Morehouse had a recent leader - now retired - several of whose actions stretched the concept of family. Moreover, I am impressed by the power of corrective actions which I have experienced or heard about within the MIT context. Nevertheless, bluntly put, MIT does not have a sense of community, certainly not a sense of family, to which one can appeal in confronting the wrong of sexual harassment.

So how and what do I teach? I try to embody both the tradition of family which I learned from my parents, who presided over the extraordinary growth of an African-American women's college for 30 years, and the tradition of entrepreneurship, so valued at MIT. For instance, in my Freshmen Advisory Seminar this fall, "Comparative Experiences with Racism," we plan to work along parallel tracks, the affective and the cognitive. Last fall, in a somewhat similar experience, I was impressed with the freshmen's need to share with one another what it means to "drink from a firehose." One of the five freshmen did not pass an exam until well into November. He had profound doubts about himself and his prior preparation, and wondered quietly why he had not accepted his admission to Harvard. I assured him that if it became necessary, I would help him transfer at the end of the academic year. In the meantime, he needed solid daily effort and participation in an effective study group. When he came to my office in early January 1991, he was all smiles, and we shared in his accomplishment and faith! I plan to continue such efforts with freshmen and others.

Professor Morgan examines the paradox by which the early Virginians could simultaneously have such enormous responsibility for writing the Declaration of Independence, the Constitution, and becoming the implementers of the principles found therein as early presidents of the country, and yet through their active involvement in slavery as owners help provide an intellectual basis for racism.

On the other track we shall read, and students will lead discussions based on several books, key among them being **American Slavery American Freedom: The Ordeal of Colonial Virginia** by Edmund S. Morgan and **Why Did the Heavens Not Darken? "The Final Solution" in History** by Arno J. Mayer. Professor Morgan examines the paradox by which the early Virginians could simultaneously have such enormous responsibility for writing the Declaration of Independence, the Constitution, and becoming the implementers of the principles found therein as early presidents of the country, and yet through their active involvement in slavery as owners help provide an intellectual basis for racism. Professor Mayer discusses the context and actions by which long existing "Judeophobia" in Germany catapults into "Judeocide." These and other cases may help students think about "an intermediate range theory" of racism as well as know it when they see it.

In addition to teaching students at MIT, I have attempted to teach those in power, i.e., administrators at various levels. These attempts have been many, and my grades, judging by the reactions to my initiatives, would range from A to F. Let me try, therefore, a general statement to the MIT faculty. We need to learn to interact with one another as members of a community focused on learning. The *Faculty Newsletter* is a critical part of this quest. We should protect and strengthen this mechanism, and seek to create others. To fail to pursue such quests in these volatile times when we aspire to world leadership, collectively and individually, is myopic. For I stand with Dr. King, Jr., "Either we will live together as brothers, or die together as fools." Clearly, now we at MIT are somewhere in the middle. I believe the luxury of not having to take sides is being seriously eroded by world events well beyond our control.

Academic Council Members and Assistants

Dr. Charles M. Vest, President	3-208	X3-0148	CMVEST@MIT.EDU
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Shirley Entzminger-Merritt	E51-234	X3-8961	
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Mary Lane	E52-474	X3-7150	
Prof. J. Kim Vandiver, Faculty Chair	5-222	X3-4366	KIMV@ATHENA.MIT.EDU
Sheila McNary	5-222	X3-9713	
Ms. Kathryn A. Willmore, Executive Asst.	3-203	X3-1704	KAW@EAGLE.MIT.EDU
Elizabeth Herrick	3-203	X3-1707	
Prof. Mark S. Wrighton, Provost	3-208	X3-1971	WRIGHTON@EAGLE.MIT
Christine Graves	3-208	X3-1971	

TO: MIT Faculty

FROM: Deans Bob Birgeneau, John de Monchaux, Phil Khoury, Joel Moses and Lester Thurow; Provost Mark Wrighton and Associate Provost Jay Keyser

DATE: September 12, 1991

SUBJECT: Faculty Lunchroom

COME! COME! COME!

TO THE NEW FACULTY LUNCHROOM IN 9-350

We are pleased to inform you of the creation of a Faculty Lunchroom in 9-350. This room will be available from noon to 2 PM during the academic year. It will serve sandwiches, hot and cold drinks, and cookies all for only $2 per person! These lunches are being subsidized by us as a means of increasing the collegiality of the faculty. Our goal is for faculty in all departments in the Institute to meet each other and learn from each other.

The room which is assigned to the Center for Advanced Engineering Studies is located in the area where the Knight Journalism Fellows are housed. Knight Fellows are also invited to the lunchroom.

The Faculty Lunchroom will begin operation on **SEPTEMBER 23, 1991**. We hope you can join us, and keep coming whenever you can.