Massachusetts Institute of Technology

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MIT Faculty Newsletter

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in this issue we offer Rick Danheiser's final From The Faculty Chair (page 4); "What Will Remain Post-Pandemic?," (page 13); the naming of the Dixie Lee Bryant (1891) Lecture Hall (page 18); "On the 20th Anniversary of OpenCourseWare," (page 22); and "Education for Non-Robots," (page 27).

MIT Spring 2021

Lily Tsai New Chair of the Faculty

Newsletter Staff

LILY L. TSAI, FORD PROFESSOR of Political Science, will succeed Rick Danheiser as Chair of the Faculty on July 1, 2021. Lily has served as Chair-Elect during the current academic year, learning the ropes from Rick to whom she is thankful for exemplary leadership during this particularly trying time. Joining Lily as faculty officers this summer will be Chris Schuh (Materials Science and Engineering) and Martha Gray (Electrical Engineering and Health Sciences and Technology) who will serve, respectively, as Associate Chair and Secretary of the Faculty.

Born in Stillwater, Oklahoma, Lily grew up in New Jersey. After three years of high school, Lily left home at 16 to serve as a Congressional intern for Senator Bill Bradley and to work for the International Republican Institute in Washington, DC

continued on page 10

MIT Plans for the Fall Semester

Cynthia Barnhart

AT THE APRIL 21 AND May 12, 2021 Institute Faculty Meetings, I joined several colleagues to update the MIT community on the state of our planning for the fall 2021 semester.

As I write this in the middle of May, we are on track to implement the framework President Reif announced in March: a return to full academic and research activities by the start of the new academic year in September.

All students have been invited to be in our residence halls, classrooms, and laboratories so that they can take part in in-person learning, research, and co-curricular and athletic activities. Faculty and staff who worked on campus before Covid and have not yet returned have been told to plan for resuming in-person work by September 7, 2021. We will know more later this summer about

continued on page 12

Editorial

I. Greetings to our Graduates in the Year of the Pandemic
II. The Role and Reach of the MIT Faculty Newsletter
III. Thank You

Greetings to our Graduates in the Year of the Pandemic

WHAT A YEAR! For many of us it is hard to imagine the difficulties you have navigated through this past year of the pandemic. MIT's faculty values and takes particular pride in the accomplishments of your Class of 2021. Teaching and mentoring students has required development of new skills and commitments, but it has also been a source of deep satisfaction for us. Your senior year has been extraordinarily stressful due to the Covid-19 pandemic, but as you have learned and grown, absorbing and generating knowledge and new insights, so have we. The future contributions to our communities and to society will be among the most gratifying outcomes of our joint academic efforts.

continued on page 3

contents

The MIT Faculty Newsletter
Editorial Board

Vol. XXXIII No. 5 May/June 2021

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Greetings to our Graduates
continued from page 1

The class of 2021 will be entering a world of considerable uncertainty and an increased level of social and political polarization. After the 2016 presidential election, many of our students and graduates rose to the challenges presented by the Trump administration and its method of governing. You joined efforts to protect international members of our community from the threat of exclusion or deportation. You became attentive to issues such as immigration, climate change, nuclear disarmament, the reduction of global poverty, and the need to protect fundamental democratic rights. Many of you joined or supported the Women's March, the March for Science and the March for Climate; many of you supported the various efforts of the Black Lives Matter movement.

The values of scientific investigation and assessment, previously taken for granted, have now become arenas for contention and even denial. Defending these values will require the urgent involvement of us all. In the international area, conflicts among nations that may have once seemed very far away have intensified. We have to take more seriously our responsibilities as citizens to ensure that our nation's actions in the world increase the prospects of peace and prosperity for the world's peoples, rather than undermining them.

During your time here the campus experienced a revival in student engagement. Examples include: the fossil fuel divestment campaign; the continuing opposition to MIT's agreements with the Saudi Arabian monarchy; the campus die-in led by Black students; the protest and counter-forum to Henry Kissinger's role as spokesperson for ethics in artificial intelligence; the revival of MIT Students Against War; and many other expressions of social, economic, and political concerns.

During your years with us, we on the faculty have watched the burgeoning of your many talents, your creative ambitions, your resilience in the face of setbacks, your thoughtful and quirky self-expression, and your creative and entrepreneurial energy. We hope that, as your individual paths unfold, you will put your powers to work on solving some of the problems that confront us all, and on making our society more responsibly productive and more supportive of those in need. On behalf of the entire faculty, we wish the class of 2021 – facing a more uncertain environment than any graduating class in decades – vision, strength, commitment, wisdom, and success, in addressing the unique challenges you will face. ■

The Editorial Board of the MIT Faculty Newsletter

The Role and Reach of the MIT Faculty Newsletter

Very few university faculties across the nation have an independent newsletter for their expression. Given that MIT plays a somewhat distinctive role in the national and international academic community, we don't limit our scope to campus issues. The *Faculty Newsletter* website (https://fnl.mit.edu) is regularly visited by thousands from across the nation and from more than 50 foreign countries. Thus, the recent Special Edition: Women in Biotech was of regional and national significance. We have a long history of attending to the danger of nuclear war, and the current issue carries an article on the new $100 billion Intercontinental Ballistic Missile. FNL articles attempting to address systemic racism don't pretend it can be eliminated on one campus without broader social transformation. These articles represent an attempt to recognize our responsibilities as broader than our day-to-day faculty tasks. Faculty members are welcome to submit articles that address national or international affairs that they believe deserve the attention of our colleagues.

Thank You

The *Faculty Newsletter* wishes to offer our sincere thanks and appreciation to two of the tireless MIT personnel who have enabled us to increase dramatically the electronic outreach of the FNL during the Covid-19 pandemic. Special thanks goes to Stacie Slotnick, Director of Communications and Michael Glynn, Senior Business Systems Analyst, in the Human Resources Department. Without their invaluable guidance and assistance we would have been unable to notify many of you of the publication and offer electronic access to the current FNL issue.

We would also like to thank Susan Goldhor for her most generous financial contribution to the coffers of the *Newsletter,* in memory of former Editorial Board member Professor Aron Bernstein. In particular during these financially restrictive times, her generosity will allow for the FNL to sponsor programs and events for the edification of the wider MIT community. Thank you so much. ■

Editorial Subcommittee

From The Faculty Chair

A Look Back and a Look Ahead

Rick L. Danheiser

IN THIS, MY FINAL COLUMN as Chair of the Faculty, I take a look back at some of the key contributions and accomplishments of Faculty Governance during these past most unusual two years. I also take this opportunity to provide a progress report on some of the more important initiatives currently underway that I hope will be continued under the guidance of my successor as Faculty Chair, Professor Lily Tsai.

The Epstein Affair and Outside Engagements

The first six months of my term as Faculty Chair were dominated by fallout from the revelations that began to emerge in the summer of 2019 concerning the association of convicted sex offender Jeffrey Epstein with the Institute. On January 10, 2020 the Executive Committee of the MIT Corporation released the long-awaited report by the law firm of Goodwin Procter (GP) on Epstein's involvement with MIT. Previously I had obtained agreement from Bob Millard, the Chair of the MIT Corporation, for a group of 12 current and former officers of the faculty to meet with representatives of GP following our review of the report. The meeting with the GP lawyers took place on January 13 and lasted four hours, and a summary of our findings was sent to the Faculty on January 21. I have written about these findings in my January/February 2020 FNL column "Epstein and MIT: The Unanswered Questions."

In August 2019, soon after the first revelations about Jeffrey Epstein's donations to the Institute, I had suggested to my fellow faculty officers and to Provost Marty Schmidt that I believed that MIT needed a group to develop principles and improved processes to define what were and were not acceptable outside engagements. After discussions at several meetings of the Faculty Policy Committee (FPC), and after consultation with other key faculty including several former Faculty Chairs, I convened an Ad Hoc Faculty Committee on Guidelines for Outside Engagements. The charge to this committee was to define a set of values and principles, consistent with MIT's mission, to guide the assessment of outside engagements, where outside engagements would include grants, gifts, and any other associations and collaborations involving MIT with governments, corporations, foundations, or private individuals, domestic or foreign. A draft version of the report of this "principles committee," chaired by Professor Tavneet Suri, was posted for comment in September 2020.

Concurrent with these discussions, President Reif asked Provost Schmidt to convene an Ad Hoc Committee to Review MIT Gift Processes, and the draft version of the report of this "processes committee," chaired by Professor Peter Fisher, was also posted in September.

Comments from the community on the two draft reports were collected via websites as well as at an October 6 Community Forum that I convened jointly with Provost Schmidt. Both reports were discussed extensively during the fall at meetings of Academic Council, the Faculty Policy Committee, and the MIT Corporation. In a letter to the MIT community on January 11, Provost Schmidt and I announced the posting of the final, revised version of each report, and informed the community that President Reif had appointed an ad hoc advisory group including administration and Corporation members and Professors Suri, Fisher, and Faculty Chair-Elect Lily Tsai to advise him on how to best implement the committee's recommendations.

Next Steps. In a letter to the Faculty on May 7, Provost Schmidt announced that President Reif had accepted most of the recommendations of the Fisher "Processes Committee" and that he was commissioning a six-month experiment involving the Interim Gift Acceptance Committee (IGAC) which will be expanded by the addition of three faculty members (Professors Fisher, Suri, and Li-Huei Tsai). Effective immediately, the expanded committee will apply the tools developed by the Suri "Principles Committee" in the evaluation of potential gifts to the Institute. After six months, the Advisory Group appointed previously by President Reif will reconvene to review the results of the experiment and to advise President Reif on the path forward.

It is important to note that *gifts* to the Institute are the exclusive focus of the review and evaluation process outlined above and which is currently underway. The charge of the Suri "Principles Committee," on the other hand, included defining guidelines for other categories of engagements, such as those involving corporations and foreign governments. I believe it is important that the tools developed by the Suri Committee not be restricted to the evaluation of gifts. Once the current review of the application of the Suri Committee tools to gifts is complete, I hope that Faculty Governance will work with the Administration to plan the

continued on next page

A Look Back and a Look Ahead
Danheiser, from preceding page

expansion of these procedures to encompass other categories of funding. Because the nature of other types of funding differ in fundamental ways from gifts, I would like to suggest that it may be appropriate to convene a new "Ad Hoc Committee on Processes for Non-Gift Engagements," analogous to the Fisher Committee, to propose the next steps in this direction.

Faculty Governance

Governance has been a major focus of attention by the Faculty Officers and the Faculty Policy Committee during my term as Chair. Our overarching goal in this area has been to make our system of faculty governance more democratic, ensuring that a full range and diversity of views are represented in the discussion of issues and in decision-making. I previously outlined our aims in my November/December 2019 FNL column "'A Peculiar MIT Concoction': Our System of Faculty Governance." Below I outline our progress toward achieving these goals and the efforts currently underway.

The Committee on Nominations. As I discussed in detail in the above-referenced FNL column, in 2019 the Faculty Officers and the FPC began to urge that changes be made in the way that the key Committee on Nominations is appointed. In contrast to the manner in which candidates for the other 10 Standing Committees of the Faculty are chosen, *Rules and Regulations of the Faculty* called for the members of the Committee on Nominations to be appointed by the President, who also selected the Chair of the committee. If nothing else, this encouraged a perception that the Administration exercised significant influence over the membership of the committees of faculty governance. At the March 2020 Institute Faculty Meeting, I introduced a motion on behalf of the FPC for amending *Rules and Regulations* so that the membership of the Committee on Nominations would be elected by the Faculty, with the candidates for the election suggested by the elected Officers of the Faculty with allowance for additional candidates to be nominated by the usual process by the Faculty-at-large. This motion was overwhelmingly passed at the April 2020 meeting of the Faculty.

Faculty Meetings and the Application of Electronic Technology. In my November/December 2019 FNL column I suggested that the election of the faculty officers and members of the faculty committees might be carried out more democratically through online voting rather than by a show of hands at the usually sparsely attended May Institute Faculty Meeting. The aim of this change would be to enable wider participation of the faculty in these important elections.

As it turned out, the Covid-19 emergency expedited the implementation of this proposal, as beginning in March 2020 it became necessary to hold all of the Institute Faculty Meetings virtually using Zoom technology. Each of the Faculty meetings since then have attracted several hundred attendees, usually including three times the typical pre-pandemic number of faculty. Voting on motions and on the election of the new faculty committee members has been conducted electronically, employing an online voting platform developed by FPC members Professors Ike Chuang and Duane Boning, and there is general agreement that this system has functioned very smoothly and efficiently.

The question of whether to hold future post-pandemic faculty meetings virtually or in person has been under active discussion at meetings of the FPC this spring and in conversations of the Faculty Officers with the Administration. Clearly, virtual Faculty Meetings enjoy several advantages as compared to our traditional in-person meetings. Participation is more convenient for many faculty, particularly those with family and other responsibilities that make attendance in person difficult and problematic. Some colleagues find it less intimidating to raise questions and to participate in discussions in the virtual format, and Zoom meetings provide a chat function enabling further live discussion during the meeting. On the other hand, a number of colleagues have lamented the loss of opportunities for informal interactions before and after live meetings, and have suggested that there is intangible value to gathering all of the faculty and administration together at least once each month. Plans for the fall are still under discussion, but possibilities include following the lead of some of our peers and scheduling a mixture of meetings in live and virtual format, or developing a "hybrid" system that would allow remote participation of some faculty in a live meeting being held in 10-250.

It is clear that the application of electronic technology in faculty meetings will continue and see further development and expansion in the coming academic year. If "live" meetings resume, then one innovation worth considering would involve providing an online vehicle for faculty not in attendance at the annual May meeting to vote electronically on the candidates for faculty officers and the members of faculty committees. In one scenario, online voting (restricted to faculty members) would be open during a period of several days leading up to the May meeting. Online voting on motions also deserves consideration, but is more complicated in view of the importance of ensuring that those voting have full knowledge of the discussion of the motions that take place at the meeting.

One concern that I share with a number of colleagues is that the monthly Institute Faculty Meetings provide limited opportunities for input from a wide range of faculty and for a truly substantive discussion of important issues. Much of our monthly meetings are necessarily taken up with "housekeeping" matters – obligatory motions and voting on changes to *Rules and Regulations of the Faculty*, as well as with annual reports to the Faculty that in some cases are prescribed by *Rules and Regulations.*

continued on next page

A Look Back and a Look Ahead
Danheiser, from preceding page

During the past two years, as one vehicle to address this, the Faculty Officers have convened a series of 60-90 minute "Town Hall" meetings, each focused on a single topic, and each including only a short presentation in order to allow for extensive discussion by the faculty present at the meeting. I hope that these supplements to our regular monthly Institute Faculty Meetings will continue in the coming year with the number expanded in the future, as I believe that they serve as an excellent means for more substantive discussion of issues than is possible in our regular meetings of the Faculty.

I personally also would like to see the introduction of an *online faculty discussion forum* in the future to supplement the discussion of selected key issues at Town Hall and Faculty Meetings. During the past two years, there has been some consideration of an online faculty discussion forum at meetings of the FPC, and the creation of such a forum has also been suggested by several faculty, including David Karger of EECS. I would like to propose that the FPC and the Faculty Officers pilot an online faculty discussion forum in the coming year. Access would be limited to the MIT Community and only faculty would be permitted to post on the forum. The Faculty Officers would set a topic for discussion on the forum, which would then be opened for comments (with a word limit!) by members of the faculty. The value of such a forum is that it would allow for a true extended conversation among faculty members on a topic over an extended period of time, in between Faculty Meetings, and without the time constraints associated with meetings.

Faculty-Corporation Communication

MIT operates with a system of "shared governance" under which the Faculty, the Administration, and the Corporation all have roles in plotting the direction of the Institute and the management of its day-to-day affairs. In the wake of the revelations concerning Jeffrey Epstein's interactions with MIT, the Faculty Officers heard calls from a number of quarters suggesting that the role of the Faculty in the governance of the Institute should be re-evaluated with the aim of "re-balancing" the Faculty's role relative to the Corporation and the Administration. Toward this end, a Faculty Town Hall meeting was convened on February 5, 2020 to engage the MIT faculty in a "community brainstorming session" to consider ways in which the shared governance system of the Institute might be improved. This discussion continued at the Institute Faculty Meeting that February and resulted in a call to establish a working group on the engagement of the Faculty with the MIT Corporation. While effective vehicles for communication between the Faculty and Administration, and between the Administration and the Corporation exist, there is little opportunity for direct communication between the Faculty and Corporation aside from the Visiting Committees which are necessarily focused on "local" issues of concern to a particular department.

I began discussions with Corporation Chair Bob Millard to create this working group shortly after the February 2020 Faculty Meeting, but these discussions were suspended that March with the advent of the Covid-19 emergency. This past fall I resumed these discussions with the new Chair of the Corporation, Diane Greene, and at her invitation made a presentation on the topic at the quarterly meeting of the Corporation in December. At the March Corporation Meeting, Diane Greene presented a resolution "To establish an ad hoc committee to review existing mechanisms of engagement between MIT faculty and the Corporation and evaluate whether different or additional mechanisms are desirable . . . ." The Corporation approved this resolution and as of this writing Diane and I are in the process of scheduling the first meeting of the ad hoc committee. Joining me on the committee are Faculty Chair-Elect Lily Tsai and Professors Dan Hastings and Tom Kochan, while Diane Greene has appointed Drew Faust, Ken Wang, Colin Webb, and Songyee Yoon from the Corporation as members of the committee.

Promotion and Tenure

Improving MIT's promotion and tenure processes has been among the top priorities on my agenda since the beginning of my term as Chair of the Faculty. I began discussing aspects of promotion and tenure with Provost Marty Schmidt in the summer of 2019, and this has been the subject of several meetings of the Faculty Policy Committee during the past two years. Among the questions under discussion have been whether improvements might be possible with regard to fairness and the level of transparency in our processes, whether the criteria used in evaluating faculty for promotion are appropriate, and whether our current procedures make the most efficient use of faculty time.

These conversations actually constitute a continuation of a review initiated by then Faculty Chair Bish Sanyal in 2009 which led to a report of a special ad hoc faculty committee chaired by Tom Kochan and Bob Silbey. One of the recommendations of the Kochan-Silbey committee involved improvements in the process by which grievances related to tenure are addressed, and this recommendation ultimately led to the development of the revised policy described in Section 3.3 of *Policy and Procedures*. Unfortunately, no action was taken on any of the other recommendations of the Kochan-Silbey committee in subsequent years. During my term as Chair I have urged that a number of these recommendations be revisited, and discussion of these aspects of promotion and tenure have taken place over the past year at meetings of Deans Council (of which I am a member) and at meetings of the Deans Group of Academic Council under the leadership of Provost Marty Schmidt. It should be noted that Associate Provost Tim Jamison has joined me in helping to lead several aspects of this review. I provided an interim report on progress in my

continued on next page

A Look Back and a Look Ahead
Danheiser, from preceding page

column entitled "Improvements in Policies for Promotion and Tenure are Overdue" in the September/October 2020 issue of the *Faculty Newsletter*.

Criteria for Promotion and Tenure. This past fall Tim Jamison and I led a discussion of the revision of Section 3.2 of *Policies and Procedures*, the section that lays out the criteria for tenure at MIT. The new wording, which was approved by Academic Council in December, is shown below. Explicit reference to mentoring and advising was added to one paragraph of this section since consideration of a candidate's performance in these areas has been part of the evaluation in promotions for some time. A second paragraph of Section 3.2 was also revised, in this case to explicitly recognize that what is considered in the evaluation of scholarly impact can vary considerably between different disciplines. These paragraphs of Section 3.2 now read as follows:

Persons awarded tenure must be judged by distinguished members of their discipline to be of first rank among scholars and to show promise of continued contribution to scholarship. Tenured members of the Faculty must also demonstrate outstanding teaching, mentoring, advising, and university service; however, excellence in these important roles is not in itself a sufficient basis for awarding tenure.

A single standard of exceptional quality, as confirmed by distinguished members of their disciplines, applies across the Institute. However, it should be noted that what is used as evidence of scholarly achievement and impact will vary based on the discipline and its modes of inquiry and that the opportunities for mentoring, advising, and university service also will vary among different departments.

Communicating Processes and Expectations to Pre-Tenure Faculty. One of the concerns raised in the Kochan-Silbey report was that the processes and expectations for tenure are not always communicated clearly to new faculty. This problem persists. In the 2020 Quality of Life Survey, 48% of the pre-tenure faculty respondents disagree with the statement "the criteria for tenure are clearly communicated." That room for improvement exists is consistent with my own experience based on informal conversations with junior colleagues. This past fall, I suggested to Deans Council that each School create a website (possibly accessible only to MIT faculty) outlining the expectations, timetable, and processes for promotion at each rank. "Expectations" would include the general policy with regard to the relative role of research, teaching, mentoring, and service in evaluations for promotion. The role of internal and external letters would be described on each website with an indication of how letter writers are selected. In addition, these webpages would discuss the various stages of review at the department level and subsequently at the level of the School Council and at the Appointments Subgroup of Academic Council.

After considerable discussion, Deans Council directed each School to develop websites along these lines with the expectation that the posting of these sites would be completed by June. It should be emphasized that these websites do not replace the meetings that Department Heads hold with junior faculty and will not be a substitute for other more detailed vehicles for orientation of faculty on these procedures.

Aligning Processes. In the course of the meetings of Deans Council on the subject of communication and these websites it emerged that there are surprising differences among Schools with regard to certain minor aspects of the processes for promotion and tenure. This has led to discussions currently underway to increase the alignment of some processes among Schools.

Simplifying Faculty Ranks. MIT is almost unique in having four tenure-track professorial ranks: Assistant Professor, Associate Professor without Tenure ("AWOT"), Associate Professor with Tenure ("AWIT"), and Full Professor. At MIT, promotion to AWOT, AWIT, and to Full Professor each involves an extensive and rigorous review. The most important component in each review involves "external letters" which are solicited from a number of international leaders who are asked to discuss in detail the candidate's contributions in research and scholarship. Most of our peers have only three faculty ranks, and at most universities promotion to Associate Professor carries with it the award of tenure. Caltech, for example, has only two faculty ranks, having simplified their system about seven years ago to comprise only the rank of Assistant Professor (untenured) and Full Professor (tenured).

Calls to reduce the complexity of the MIT system have been heard for decades for reasons that I summarized in my September/October 2020 FNL column. The Kochan-Silbey report suggested that the promotion from AWIT to Full Professor be conducted without the need for outside letters and at my urging this simplification of our system has been discussed at meetings of Deans Council and Deans Group this past year. Proponents of eliminating external letters for this promotion argue that evaluation of continued excellence in scholarship can be made on the basis of a set of "internal letters" from MIT faculty, who obviously can also comment on the candidate's teaching and service contributions at MIT. It has been noted that it is extremely rare that promotion to Full Professor is denied after an external review because of weak outside letters. This is due to the fact that undertaking a promotion to Full Professor is typically delayed by the department if there is any doubt about the outcome of an external review.

Unfortunately, although some Deans and School Councils favor this change, others believe that a review by outside authorities is essential and that the importance of retaining this review outweighs

continued on next page

A Look Back and a Look Ahead
Danheiser, from preceding page

the effort and drawbacks associated with soliciting an adequate number of external letters. Since there is agreement that consistency in policy across the Institute is advisable, it does not appear that progress on this point is likely in the immediate future.

Mentoring of Pre-Tenure Faculty. The Kochan-Silbey committee found the state of mentoring across Schools and departments at MIT to be "a significant concern" and recommended that guidelines for mentoring be created and made more uniform throughout the Institute. I agree with the importance of improvements in this area, and strongly support the review of mentoring currently underway under the leadership of Associate Provost Tim Jamison.

Graduate Student Funding

Another top priority on my agenda as Faculty Chair during the past two years has been addressing the high cost of supporting graduate students at MIT as compared to our peers. For some years I have argued that the high cost of grad students is so serious as to pose an existential threat to our competitiveness as a premier research institution.

Concerns in this area are not new, and in the fall of 2016 Provost Marty Schmidt convened a Working Group on Graduate Student Tuition Models to study the problem. This committee, chaired by Professor Steve Bell of Biology, submitted their report in July 2018, but no action had been taken when I assumed office as Chair of the Faculty one year later. Beginning that summer, I communicated my feelings about the urgency of this problem to Provost Schmidt in our personal meetings and also made it a topic for discussion at meetings of the Faculty Policy Committee. Recognizing the importance of this issue, Provost Schmidt scheduled discussions of graduate funding at several meetings of the Deans Group of Academic Council during the current academic year, and attendees at the recent Faculty Town Hall on May 5 know that the Provost and the Administration have identified the high cost of graduate students as part of a "research deferred maintenance" problem that is now regarded as one of the highest "strategic priorities" for the Institute.

Graduate student funding is also receiving attention from Task Force 2021, for which I serve as co-chair together with Professor Sanjay Sarma. As discussed in my January/February 2021 FNL column "Task Force 2021 and Beyond – Toward 'Building a Better MIT'," we have assigned one of the 16 Refinement and Implementation Committees ("RICs") of Phase 2 of the Task Force to consider approaches to the problem of graduate student funding. Both the Research Working Group and the Financial Modeling Group of Phase 1 of the Task Force had highlighted the high cost of graduate students at MIT as an important priority for attention, and RIC 15, chaired by Professor Steve Buchwald of Chemistry, is working with Provost Schmidt to develop a plan to address this longstanding and urgent aspect of "research deferred maintenance."

Education and Academic Programs

The crisis brought on by the Covid-19 global pandemic has required significant changes in our academic policies to accommodate the profound impact of Covid-19 on our educational enterprise. In my March/April 2020 FNL column "Education in the Time of Covid-19" I summarized the initial steps taken by Faculty Governance which included the development of emergency academic regulations and the mandating of an alternate pass/no-record-type grading system for the spring 2020 semester. Responsibility for steering our academic programs through the pandemic was then assumed by a new committee I convened in late spring 2020, the Academic Policy and Regulations Team (APART). I have chaired this committee, whose membership includes students and the current and recent chairs of the key Faculty Governance committees concerned with the Institute's educational mission. APART continues to work in coordination with key standing committees of the Faculty and with the Administration to develop necessary regulations and policies in response to the challenges to our academic program caused by the pandemic.

Progress in improving our undergraduate and graduate academic programs has been made in spite of the significant disruption caused by Covid-19. Unfortunately, space constraints do not permit a detailed review in this column of all of the important work in this area by Faculty Governance during the past two years. In this last section, I therefore focus on several ongoing efforts and initiatives planned for implementation in the near future.

The Undergraduate Program. My interest in serving as Chair of the Faculty was largely motivated by my desire to see the Institute undertake a comprehensive review of the undergraduate academic program including the General Institute Requirements. It will be recalled that the last comprehensive review of the undergraduate curriculum was by the Task Force on the Undergraduate Educational Commons chaired by Professor Robert Silbey. The Silbey Task Force issued its report in 2006 and a subcommittee of CUP was subsequently appointed to refine the recommendations of the Task Force and to develop motions for consideration by the Faculty. These motions were presented to the Faculty for approval in 2009. After debate spanning several meetings, the Faculty voted to implement significant changes in the HASS component of the GIRs, but a second motion, in this case for changes in the SME (Science-Math-Engineering) component of the requirements, was not approved.

I discussed my thoughts on the creation of a new Task Force on the Undergraduate Academic Program with members of the senior leadership in early 2019, prior to agreeing to be nominated as Faculty Chair. The original plan we discussed called for the creation of a new

continued on next page

A Look Back and a Look Ahead
Danheiser, from preceding page

Task Force to be charged by me (as Chair of the Faculty) jointly with Vice Chancellor Ian Waitz, with work by the Task Force to begin in January 2020. Unfortunately, a series of unforeseen crises – first, the "Epstein Affair" in the fall, and then the global pandemic that began in March – led to the indefinite postponement of work on this Task Force.

With prospects now appearing to favor a return to normalcy in the fall, I have assigned one of the Refinement and Implementation Committees (RIC 1) of Task Force 2021 to consider whether to convene the postponed Task Force, and if so, to draft a charge and suggest potential membership. I am chairing this RIC, and am joined on the committee by six other faculty: CUP Chair Arthur Bahr, Associate Faculty Chair Duane Boning, Director of Concourse Anne McCants, Dean for Digital Learning Krishna Rajagopal, Faculty Chair-Elect Lily Tsai, and Vice Chancellor Ian Waitz. We anticipate completing a report this summer.

The Graduate Program. Two Refinement and Implementation Committees of Task Force 2021 are working on improvements to the graduate program.

Beginning in September, Ian Waitz, Tim Jamison and I had held discussions on the need to enhance the scope and effectiveness of graduate student advising, and similar discussions were taking place concurrently in CGP (the Committee on Graduate Programs) led by Professor Martha Gray. For Phase 2 of the Task Force, Sanjay and I created RIC 4 to develop a plan to implement the recommendations of these groups as well as related ideas proposed by the Student Journey Working Group of Phase 1 of the Task Force. RIC 4 has recently completed its work, developing a charge for an Ad Hoc Committee on a Strategic Plan for Graduate Advising and Mentoring which will be co-chaired by Professors Paula Hammond and Tim Jamison.

Several groups in Phase 1 of Task Force 2021 proposed ideas aimed at implementing "holistic graduate education," a goal that also has been under discussion in CGP during the past year. RIC 3 has been convened and assigned to consider the introduction of professional development opportunities for graduate students, including perhaps even a "professional perspective requirement," which might be satisfied by internships (both corporate and social-good), by research exchanges and research collaborations with companies, and via the exploration of non-research careers through teaching experiences and other activities. This committee will be issuing its report before the end of June.

Postgraduate Education. "Lifelong learning" and other aspects of postgraduate education are central to the ideas posed by several groups of the Academic and Administrative Workstreams of Phase 1 of Task Force 2021. For example, the "Beyond MIT" Working Group noted that "we currently lack a coherent vision and plan for an MIT 'Postgraduate Education of the Future' that makes MIT a pioneer in preparing people to work at 'good jobs' of the future." This group then went on to propose "an MIT Postgraduate Education of the Future Initiative" that "would establish a new college or university-wide unit at MIT dedicated to online postgraduate education with a range of postgraduate subjects and coherent, intentional programs." RIC 11 (Lifelong Learning/Postgraduate Education), chaired by Sanjay Sarma, has been charged with evaluation of this recommendation and related recommendations of the Education and Financial Modeling Working Groups, and will be proposing a plan forward in their report, due before the end of June.

While there is no question in my mind that programs in postgraduate education and lifelong learning are consistent with MIT's educational mission, I and others have raised questions about the extent to which the Institute should expand its efforts in this area. Concerns include the extent to which these efforts might divert faculty time away from residential teaching, and proposals to augment faculty instructors with non-faculty lecturers raise questions about quality control and the impact on the MIT "brand" and reputation. It has also been noted that while Faculty Governance has committees (CUP and CGP) that monitor and exercise general oversight with regard to our undergraduate and graduate educational programs, there currently is no such standing committee associated with *postgraduate* educational programs. With the prospect of significant expansion of our efforts in postgraduate education and lifelong learning in the future, I have raised for discussion consideration of the creation of a "Committee on Postgraduate Programs" (CPP) as a twelfth Standing Committee of the Faculty.

In closing, I would like to emphasize that there are a number of other issues of equal importance to those discussed in this column that have received attention from Faculty Governance during the past two years. In particular, diversity, equity, and inclusion, climate action, and aspects of student life were topics that occupied discussions of FPC and the Faculty Officers.

Finally, and last but not least, I want to express my sincere thanks to my fellow Faculty Officers Duane Boning and David Singer for their wisdom and counsel during the past two years. Both have significant other responsibilities (Professor Singer is Head of Political Science!) but have been unstinting in their effort and dedication throughout these turbulent and eventful two years. And a very special thanks to Dr. Tami Kaplan, Faculty Governance Administrator extraordinaire, whose familiarity with all aspects of Institute governance, command of MIT's myriad policies and regulations, wisdom and common sense, and remarkable dedication has been essential to all that has been accomplished by Faculty Governance during the past two years.

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Lily Tsai New Chair of the Faculty
continued from page 1

Lily L. Tsai

and in Ulaanbaatar for the run-up to Mongolia's first legislative elections. Lily attended Stanford as an undergraduate, where she double-majored in international relations with a focus on development economics, and English literature. Field research for one of her undergraduate theses took her to rural China, including villages where her grandparents had grown up poor and illiterate, only to later flee war and instability with Lily's parents. After graduating, Lily went to UC Berkeley to do her PhD research with Elizabeth Perry, subsequently moving with Perry to finish her degree at Harvard in 2005. Lily joined the MIT faculty at age 29 as an Assistant Professor in the Department of Political Science. After stints as an Academy Scholar at Harvard, she received tenure in 2009.

Lily is a scholar of governance, accountability, and political behavior and is the recipient of various awards for her research, including from the American Political Science Association and the Society of Comparative Research. She is engrossed by the strategies that ordinary people use to influence government authorities even in the absence of strong democratic institutions, how authorities and elites seek to influence and control the behavior of their constituents, and how to create public trust and trustworthiness that lead to constructive engagement and cooperation between citizens and government.

Building on her interest in engaged scholarship and real-world impact, Lily founded the MIT Governance Lab (MIT GOV/LAB) in 2016 to respond to students who seek an active role in solving public problems and engaging in civic life, while also producing rigorous scientific research.

At its core, Lily's research seeks to understand when authorities provide what people need and want, and why they often fail to do so. In particular, her work looks closely at what can be done to improve trust and cooperation, and how to increase the motivation of authorities to respond to citizen needs. In her book, *Accountability without Democracy*, Lily shows how citizens in nondemocratic systems can use informal institutions to inculcate the intrinsic motivation of authorities to respond to citizen concerns as well as reward and punish local officials by awarding moral standing. Her book, *When People Want Punishment: Retributive Justice and the Puzzle of Authoritarian Popularity* (forthcoming this year), continues the investigation of moral authority in governance to ask why some authoritarian leaders and regimes are popular with their citizens, while many democratic ones are mistrusted or held in contempt. Her research suggests that one of the most important public goods that governments can provide is social and moral order, and Lily shows that when rulers take actions that signal that they uphold moral order, citizens are more likely to support them even when they perform less well in terms of economic development, the implementation of democracy, or welfare provision.

Building on her interest in engaged scholarship and real-world impact, Lily founded the MIT Governance Lab (MIT GOV/LAB) in 2016 to respond to students who seek an active role in solving public problems and engaging in civic life, while also producing rigorous scientific research. MIT GOV/LAB has worked with practitioners, including NGOs, international organizations such as the World Bank, and governance innovation hubs to integrate social and behavioral science with data science and design thinking to develop and evaluate creative solutions, policies, and practices. These collaborations have shown that the uptake of research and policy recommendations is far greater when communities and practitioners actively recruit scientists to work alongside them on problems they themselves have identified and want to solve.

Lily has been recognized with the Office of Graduate Education's Committed to Caring Award for Graduate Student Mentoring and SHASS's James A. and Ruth Levitan Award for Teaching Excellence. Lily's contributions to curricular innovation include the development of

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Lily Tsai New Chair of the Faculty
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the Graduate Scope and Methods course and the Second Year Paper Workshop, that bookend the core PhD curriculum in political science. Through teaching these subjects, Lily had the pleasure for many years of having every PhD student in one of her classes. Under her direction, MIT GOV/LAB also developed an intensive short course on behavioral science in the field for MIT and East African graduate students held in Nairobi in collaboration with the Busara Center for Behavioral Economics, as well as a pilot mentorship program that pairs Boston-area undergraduate students from underrepresented backgrounds with PhD student mentors. Over the years, Lily has taught courses on governance and accountability, the political behavior of development, civil society and social capital, politics and religion, and the rise of the modern state. Lily has mentored more than two dozen graduate students and is the first from her department to serve as faculty advisor for the MIT Summer Research Program (MSRP).

What Lily has most valued about Institute service are the opportunities for building community and the shared sense of purpose that ideally emerges from the richness brought by a diversity of experiences and perspectives. Lily has served on the Provost's Working Group on Graduate Tuition Models, the Committee on Nominations, the MIT Staff Emergency Hardship Fund Advisory Committee, the College of Computing's SERC Group on Computing and Public Policy, MIT Solve's Challenge Leadership Group, as well as ad hoc advisory groups to the President and Provost on the Suri and Fisher committees' reports, on faculty and staff childcare solutions during Covid, and on MIT's activities in China. Since 2015, Lily has served on the Presidential Committee for Race and Diversity and is currently a member of the Steering Team for MIT's Five-Year Strategic Action Plan for Diversity, Equity, and Inclusion. She was part of a faculty effort across all five Schools to institute School Faculty Gender Equity Committees with a male and female co-chair in each School to review data on gender equity and formulate recommendations for policies and practices. For Task Force 2021 and Beyond, Lily co-chaired the Beyond MIT group in the Academic Workstream during Phase 1, and she is currently chairing the Refinement and Implementation Committee on Social Responsibility for Phase 2.

What Lily has most valued about Institute service are the opportunities for building community and the shared sense of purpose that ideally emerges from the richness brought by a diversity of experiences and perspectives.

Outside of social science and governance innovation, Lily enjoys running (though her knees now require her to run shorter distances), practicing the piano, and hiking. Big Sur and the Aletsch Glacier are two of her favorite places to visit.

MIT Plans for the Fall Semester
Barnhart, from page 1

what "in-person work" looks like for fall in terms of days and hours on campus, but faculty and staff should be in the area and be prepared for in-person teaching, meetings, and other types of work they engaged in before the pandemic.

At the same time, the Work Succeeding effort to define new ways of working is well underway. Models will be piloted this fall so that we can create a roadmap for how to work together more flexibly, effectively, and equitably. And we fully expect that many of the successful learning methods deployed during the pandemic will continue to be leveraged in the coming academic year.

There are admittedly many decisions that need to be made to give our community a more complete picture of what to expect in the fall. We have relied on faculty meetings, 8 am morning calls, student office hours, and a host of committees and working groups with broad representation to engage our community in fall planning efforts. In order to help everyone prepare for the fall, our goal is to make timely decisions based on sound science; on the lessons we've learned throughout the current academic year; and in support of creating a safe campus environment that will enable us to advance MIT's academic and research mission.

Summary of next steps in the fall planning process

Here is a brief summary of the decisions that we have already made, or will be making, in the near term:

• Following consultation with medical experts, consideration of best public health practices, a review of how other institutions of higher education are approaching student vaccine requirements, and state and national guidance, we are requiring every student to be fully vaccinated against Covid-19 before the fall semester begins. We will work to accommodate those students who cannot be vaccinated due to medical or religious reasons.

As the vaccination rate within our community increases, the need for policies to keep our community safe from Covid decreases. We fully expect that many of the Covid-era limitations on campus and building access, room capacity, guests in residence halls, and events and gatherings will either be much less restrictive or eliminated in the fall….We expect to expand the types of campus visits that enable, for example, admissions tours, workshops, and other campus events and academic collaborations.

• We are still considering whether to pursue a vaccine requirement for MIT staff, faculty, contractors, and others who will regularly access campus in the fall. To help us make an informed decision, all employees, contractors, and other workers were told to share their current vaccine status with us by May 23. We expect to be able to inform the MIT community in early June whether an employee vaccine requirement will be implemented for the fall.

• As the vaccination rate within our community increases, the need for policies to keep our community safe from Covid decreases. We fully expect that many of the Covid-era limitations on campus and building access, room capacity, guests in residence halls, and events and gatherings will either be much less restrictive or eliminated in the fall. We do not know yet whether additional visiting appointments such as visiting students and scholars will remain paused for fall as we increase the MIT community density. We do, however, expect to expand the types of campus visits that enable, for example, admissions tours, workshops, and other campus events and academic collaborations.

• As noted above, we expect that students and faculty and instructors will be teaching and learning in-person. We recognize that there could be exceptional situations to this requirement and we will evaluate them on a case-by-case basis.

• To support the "slow dialing-up" for summer that President Reif described in his March letter, capacity restrictions in labs and offices will be lifted in early June to accommodate employees and students who are currently in Covid Pass and working on campus and in off-campus research facilities such as Bates. While eating indoors together has been limited intentionally in our non-residential buildings, this restriction will also be relaxed with some prudent guidelines for those working on campus this summer.

• We will continue to evaluate all other areas of Covid policy, and be prepared to make changes based on the latest public health data and state and city requirements.

In conclusion

We owe an enormous debt of gratitude to the students, faculty, and staff who came to campus throughout the current academic year as well as those who have been studying or working remotely. It hasn't been easy, but we have our sights on the future as we look forward to the fall and a return to the rhythms and connections of campus life that we have all sorely missed during the pandemic.

Please note that a decision on whether to implement an employee vaccine requirement was expected to be announced to the MIT community the week of May 31, 2021. Check MIT Now for the latest updates.

Cynthia Barnhart is Chancellor and the Ford Foundation Professor of Engineering *(cbarnhar@mit.edu).*

What Will Remain Post-Pandemic?

Shigeru Miyagawa
Meghan Perdue

AS UNIVERSITIES RETURN TO in-classroom teaching, what practices that emerged during the pandemic will carry over?

While we are all anxious to get back to teaching and working on campus, it is unlikely that we will go back completely to the pre-pandemic ways, given the enormous disruption we are living through. We interviewed more than 30 MIT faculty members about teaching and working during the pandemic, and these interviews gave hints of what we might expect will remain once we begin teaching face-to-face again. While adoption of technology naturally played an important role, we found even more striking a fundamental shift in the faculty's attitude toward students and teaching. We believe that this will have a deep and lasting impact beyond the pandemic.

Educating the whole student

A task force charged with planning MIT's future in education has expressed "the hope that MIT will provide a more holistic education, with yet more focus on nurturing our students in intellect and spirit" (*MIT News*, 2/16/2021). Knowing students beyond just their academic interests changes the way one teaches. In remote teaching, we have often found ourselves in the students' own living quarters, have seen and heard the challenges they are coping with. Many students do not have a quiet space for studying, forcing faculty to vie with their family and even pets for their attention. Others had trouble accessing suitable WiFi. The struggles that the instructors saw unfolding in front of them have allowed them to understand their students in ways that are not readily possible in an in-person class.

Instructors got glimpses into students' lives in other ways as well. Knowing the stress that the students are under during the pandemic, many faculty members set aside time before, after, and even in the middle of class, for students to informally interact with their teachers and each other. Instructors were surprised by how many students took advantage of these free-form sessions, and equally surprised by questions and answers that had intensity not seen in in-person meetings. These experiences have opened the instructors' eyes to the strains that life has imposed on the students, including inequalities, which, in remote learning, have become amplified. This keen awareness of the "whole" student will carry over to post-pandemic teaching. It will serve as a way to educate students more holistically, and with empathy.

Keeping student attention

If students are going to learn, they need to pay attention. In a classroom, we take for granted that students pay attention, or at least that they are supposed to. But in online class, as an instructor lamented, "attention is a scarce resource." To combat the scarcity of attention, instructors have experimented with ways to keep students focused on the lesson, and this awareness that one has to be creative in keeping students engaged, instead of taking it for granted, will carry over to teaching practices in the post-pandemic era.

Faculty experimented with different technology to engage with their students in the online space. . . . some turned to tablets to draw and animate their lectures in real time. Some created a green screen so that they could embed themselves into different settings, allowing the impression of being on stage with the slides splashed in the background. . . . Many faculty have reported that they will continue to make recordings of their lectures available to students as a resource, even when they are teaching on campus again.

Faculty experimented with different technology to engage with their students in the online space. As a replacement for the chalkboard, some turned to tablets to draw and animate their lectures in real time. Some created a green screen so that they could embed themselves into different settings, allowing the impression of being on stage with the slides splashed in the background. In this way the students can focus their attention on one image that renders the faculty and the slides together. Many faculty have reported that they will continue to make recordings of their lectures available to students as a resource, even when they are teaching on campus again.

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What Will Remain Post-Pandemic?
Miyagawa and Perdue, from preceding page

One faculty member built what is called a Lightboard in his office for online teaching. Lightboard, which is often used in creating MOOCs, is a simple technology in which a large pane of glass is placed between the camera and the instructor. The instructor writes on the glass while lecturing, and the image through the camera is reversed, giving a mirror image, like the old Daguerreotype photography. In this way, the student can see the instructor looking at them at the same time that they can see the writing on the glass. He was thrilled with the result, and received many positive reviews from the students. When asked what he will do post-pandemic, he said that he was "scared of going back to using the board."

If an award is to be given for the most raves from instructors across disciplines, it is the chat feature in video conferencing platforms. One instructor said that when he first started to use Zoom, he saw a stream of postings on the chat, not only addressed to him but also to each other. He was puzzled by what appeared to be a distraction, but then saw that the students were engaging with the lesson and encouraging others to ask and answer questions. In a large lecture class, students liked the fact that their questions were promptly answered by a TA, which helped to keep their attention on the lesson. Many other faculty reported that the chat allowed students who weren't comfortable speaking up in class an opportunity to participate in the discussion. Many are thinking of how they can recreate the chat experience when they return to in-person teaching.

Transcending the physical space leads to convenience and inclusiveness

Being online allows us to transcend the restrictions imposed by the physical nature of the in-person class and workplace. Some of these benefits will likely carry over to the post-pandemic era.

By working online, we live "above the store," and the sheer convenience of it has had some surprising results. It has led to better attendance at meetings, leading to larger and more inclusive participation. Institute faculty meetings before the pandemic were not always well attended, and as a faculty officer pointed out, it was sometimes uncertain whether they would attain the quorum of 30. During the pandemic, the attendance has skyrocketed to 170 faculty members at its peak. Some of this is attributable to people wishing to interact with their colleagues during the isolation, but the sheer convenience of not having to commute is surely a factor. In addition to the faculty, 125 non-faculty such as staff also attended, an unusually large number; they apparently felt more comfortable attending online. Not only did the online meeting bring in more faculty, it became more inclusive in making it inviting for non-faculty members to participate in governance. It is likely that, post-pandemic, meetings of all sorts will be in hybrid mode, and in some cases, completely online.

Some faculty want to keep the sheer convenience of online teaching, at least part of the time. Many appreciated the reduction in time spent commuting each day, noting that they were able to devote that time to their families or hobbies. Others are interested in the possibilities that remote teaching could add, observing that they could attend conferences that they would otherwise have missed, or potentially participate remotely from distant research or study sites. Online office hours also worked well for many instructors, especially when the slots were made in 10-minute, one-on-one sessions with students. Many faculty reported that they would continue online office hours going forward, because they were much better attended than the in-person office hours before the pandemic.

Ever since the Internet took over our lives, the local and the global have been steadily merging, and this trend has hit a crescendo in the pandemic. Instructors invited speakers from institutions around the world to join their online classes, often scholars whose work the students read, so that the students could engage with them directly. It also helps to bring variation; instead of hearing just one instructor, students are exposed to multiple points of view. In one case, a class had 32 outside speakers, each joining for around 20 minutes. Others used the opportunity to engage communities they ordinarily wouldn't have access to, such as one faculty member who had her students do a joint project with a middle school class. And the merging of the local-global was not limited to teaching. Reading groups and research presentations, an essential component of research, found participants from across the globe. The benefits for teaching and research are so clear that it is hard to imagine that we would want to reverse the continuing merging of the local-global for teaching and research after the pandemic.

In summary

We believe that the experience of the last year, while certainly a disruption, has transformed the way that faculty interact with students and the community they work in. This attitude shift will carry over to the post-pandemic era. Faculty will be more aware of the "whole student," taking into account their lives outside the classroom. Also, they have an increased awareness of the need for creating teaching practices that keep the students engaged. They can continue using technology tools that enhance their teaching, from recorded video lectures to real-time chats. Finally, by teaching online, faculty can introduce their students to a larger world of scholars beyond their own campus, thereby substantially broadening their learning opportunities. Beyond teaching, the online mode has made it possible for many more people to participate in meetings, including non-faculty, making governance more inclusive.

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Don't Renew the ICBM Force, Eliminate It

Robert P. Redwine
Jonathan A. King

A PRESSING ISSUE THAT IS currently under consideration in Washington, DC is whether to replace the aging deployment of InterContinental Ballistic Missiles (ICBMs) with a new fleet of missiles. The Defense Department is moving forward with a plan to deploy a Ground Based Strategic Deterrent (GBSD) which would require an initial investment of about $100B and an estimated overall investment of $264B through 2075. Critics assert that such actions by the U.S. might lead to a new nuclear arms race and would actually decrease national security by increasing the risk of intentional or inadvertent use of nuclear weapons. Senator Ed Markey (MA) and Representative Ro Khanna (CA-17) have recently introduced the Investing in Cures Before Missiles (ICBM) Act that would shift funds from the GBSD to investments in the battle against biothreats.

There are indeed serious issues to consider related to the deployment of ground-based missiles in general. The United States nuclear arsenal currently has three components: ground-based missiles, submarine-based missiles, and weapons to be delivered by airplanes. The fleet of ICBMs is composed of Minuteman III missiles and is deployed in relatively uninhabited areas of the western continental U.S. The idea is, of course, that if the ICBMs were attacked by an enemy the resulting casualties would hopefully be minimized. However, we know now that if any significant number of nuclear weapons are exploded on the Earth it will be an existential threat to all humankind and to the planet.

Because the locations of the ground-based missiles, unlike those of the submarine-based and airplane-based weapons, are well known to our enemies, they can be viewed as attractive targets for those enemies. In fact, the U.S. policy is that the ground-based missiles would be launched "on warning" so as to avoid destruction by an enemy targeting them. In today's world, cyberthreats to the launch on warning system are an increasing concern. Several experts have indicated that the ground-based missile system has become a larger threat to our safety than a deterrence to our enemies. For example, William J. Perry, Secretary of Defense during the Clinton administration, has argued that "we simply do not need to rebuild all of the weapons we had during the Cold War" and singled out the GBSD as unnecessary. Also, James Mattis, a retired Marine Corps general who served as Secretary of Defense in the Trump administration, has stated that getting rid of ICBMs "would reduce the false alarm danger."

There are other disadvantages associated with the lack of mobility of ICBMs that have become more important in recent times. Both China and North Korea are nuclear-armed states and viewed as largely our adversaries. However, we would not be able to launch ICBMs in the direction of China or North Korea without violating Russian airspace, which would create a serious separate problem. Therefore, in practice our nuclear deterrence relative to China and North Korea depends only on submarine-based and airplane-based weapons.

Considering all of these issues, it seems clear that it makes no sense to continue with the GBSD program. The United States should instead decommission its ground-based missile system, as it poses more of a risk than a benefit to our national safety. We also hope that if indeed the ground-based missile system is decommissioned, it will serve as recognition that nuclear weapons systems pose existential risks to all of humanity and that the world should move as quickly as possible to eliminate all nuclear weapons.

Returning to the cost issue, even if these missiles are never used the high cost of their design, manufacture, and maintenance would rob desperately-needed civilian programs. Over the past few years, the Pentagon budget has accounted for more than half of the entire Congressional discretionary budget – our income tax dollars. One of the reasons the NIH budget – responsible for tackling all of the diseases and ills that afflict our population – is only ~4% of the Congressional budget has been the diversion of our tax dollars to weapons purchases. The contributions of our MIT faculty, students, and staff to national well-being are primarily in the civilian sector. We hope that the readers of the *Faculty Newsletter* will become active in opposing the deployment of the GBSD system. In the near term this would include supporting the Markey/Khanna legislation to move funding from the GBSD system to needed biothreat prevention.

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The More Challenging DEI – A Befitting Role for MIT

Yossi Sheffi

I READ WITH INTEREST MIT's new DEI (Diversity, Equity, Inclusion) plan circulated by the Provost. It is an impressive document and obviously the product of a lot of thought. Unfortunately, I think that as laudable as this document and the initiative itself are, we are missing a larger part of the problem: a national gap in inclusivity.

Toward a More Inclusive DEI

MIT, of course, is not the only institution engaged in DEI efforts. On most university campuses as well as in many institutions, notably media outlets and some corporations, DEI efforts are focused on internal staff. At universities, these reform efforts have centered on students' admissions, faculty hiring, and a plethora of activities aimed at re-education. Those efforts, as well as MIT's, define DEI in terms of race, gender, sexual orientation, and related parameters. In particular, universities argue that diversity of race, gender, and sexual orientation is important to generate a vibrant learning and research environment.

As notable and commendable as these goals may be, they miss an important aspect of inclusivity by a significant measure. While "standard" DEI efforts aim to help the 13% Black, or 4.5% LGBTQ in the U.S. population, they miss the vast number of people who voted for Trump in 2020.

As the 2020 elections proved, more than 74 million Americans think differently from the prevailing wisdom found on most American university campuses. Yet on many campuses, this near-majority of voters is branded as stupid, racist, misogynistic, or other "deplorables." Both the left and the right look more and more like religions: righteous, moralistic, unforgiving, and dismissive of any other belief. An imminent challenge facing this nation is to unify the country after the contentious 2020 elections.

I would like to see the ideas of Diversity and Inclusion broaden beyond the current definition and beyond the institutional four walls. Universities have a special part in this national reunification effort, which MIT can lead. At the same time that MIT continues its internal efforts – including events, proclamations, and re-education aimed at internal, standard DEI – we should think more expansively, and tackle the more critical issue of a divided nation, starting with four principles.

Principles of Expanded DEI

First, we must acknowledge the gulf of understanding between the political factions. Just as progressives are baffled and worried by the existence of so many Trump-supporting Americans, many of the initiatives in progressive institutions, such as at elite universities, baffle and frighten conservatives. Both sides are fearful of each other and just don't understand how they can think the way they do. So, it is incumbent on elite universities such as MIT – which has always looked to "make the world better" and answer the nation's calls – to step into the breach.

Second, we must avoid convenient political stereotypes spawned by the worst-case acts of a few of each group's most violent members. We should acknowledge that just as not all BLM protesters were breaking glass and looting stores in Minneapolis, Portland, and downtown Boston, not all 74 million GOP voters participated in or supported the January 6 insurrection. Vilifying an entire group for the acts of a few is a recipe for useless recrimination and hate crime.

Third, more generally, we can have no double standards for disrespecting those with whom we disagree. Currently, conservatives can still be ridiculed, called degrading names, and dismissed from university campuses. Using the same language to humiliate racial minorities or different genders is a cause for punishment and cancelation, yet no such disapprobation comes from denigrating conservative voters. I mention this double standard to make the point that purity is rare.

Fourth, violence on either side must be equally condemned. Sadly, it is not only the media and many academics that tended to ignore, or justify, violence on the left. When pictures of broken glass and looted stores in downtown Boston were playing on TV screens, Massachusetts Attorney General Maura Healey, said: "Yes, America is burning. But that's how forests grow . . . ." Thus, we tend to condemn violence on the right (and rightfully so) while "spinning" it as justifiable on the left (which is too bad). Violence and its tacit support only serves to perpetuate mutual fear and further entrench divisions.

What Would a National DEI Effort Look Like?

Imagine a call by MIT to all universities to join us in this effort comprising two broad

continued on next page

The More Challenging DEI
Sheffi, from preceding page

initiatives: (i) educate ourselves about "the other side" through primary engagements, both by visiting the other side and by inviting their representatives to campus for thoughtful presentations and debate, and (ii) expose many of the people on the "other side" to progressive values and thinking, in a respectful way. (This article's original draft advocated exposing the other side to the scientific method until a friend pointed out the anti-science stand of many progressives on GMOs and nuclear power.)

Can we develop a set of outreach, seminars, expositions, etc., aimed at understanding the "other America"? Can we engage rather than dismiss? Can we, in the elite academic institutions, go deep into "Trump country" to have open dialogue and debate in universities, high schools, churches, diners, meeting halls, and so forth?

One of the first challenges will be to bring different voices into our campus, so people cannot complain that we are not practicing what we preach. Can we ensure that these voices will be heard despite the left-wing pressure groups causing such voices to be canceled? Can we find ways to hire people with divergent points of view about immigration, racial preferences, role of religion, abortion, etc.? Is there a room on the MIT campus for a civilized debate and discussion on sensitive issues? Can we expose our students to a range of ideas and beliefs rather tacitly propagating divisiveness by shielding these young adults with "trigger warnings" from ideas or data they may not agree with?

Of course, there is always the "paradox of inclusion," which means that if everybody needs to be included, there is no right and wrong and the inclusiveness mandate rules. For dialogue and mutual understanding to be workable, there will have to be boundaries for inclusivity, which means that inclusivity is not unbounded. So, while one can argue that the moon landing was a hoax, that the holocaust never happened, that widespread fraud beset the 2020 U.S. elections, that the Republican tax plan increased taxes on most Americans, or that it is easier to get a Glock than a library book, some rules of evidence should apply.

Can we develop a set of outreach, seminars, expositions, etc., aimed at understanding the "other America"? Can we engage rather than dismiss? Can we, in the elite academic institutions, go deep into "Trump country" to have open dialogue and debate in universities, high schools, churches, diners, meeting halls, and so forth?

Many beliefs on both sides, however, are not based on unbiased evidence but on untested hypotheses, selective anecdotes, biased information flows, the need to belong, and so on. Exposing those ideas in a supportive and respectful environment can start a dialogue in which minds may not change but understanding will grow.

Moreover, we can also find more common ground than we thought we had. These may be the importance of family, hard work, equal opportunity, support for the military, and many more, which can start to change the tone in both camps. Perhaps sharing some time with someone of the opposite political persuasion might help reveal our shared humanity.

We should still be able to debate Roe vs. Wade and respect people with a different opinion. Similarly, we should be able to disagree about immigration, national healthcare, police reforms, racial preferences, education platforms, gun laws, voting regulations, or any other policy without dehumanizing people who think differently. A core goal of any inclusiveness and diversity training is on dampening people's natural fear of "other," different people as well as questioning the natural convictions that "what I and my tribe believe in is 'right.'" Let's apply this to MIT and to the nation.

MIT's Civic Duty to Be Non-Partisan

Not finding a way to include "the other side" would be a sad failure of academia. It is also a disservice to our students, who will inevitably be forced to live with these "other Americans" among their coworkers, bosses, customers, family members, and neighbors. Retreating into our ivory towers, comforted by our own echoes that our ideas are correct and true will only exacerbate the divisions in the U.S. and serve the goals of our enemies. Unfortunately, most universities, especially the elite ones, have so far been part of the problem with their elitist, intolerant monoculture. It is high time for universities to recognize the issue and start being part of the solution.

Universities, maybe especially STEM-focused ones such as MIT, have an essential civic duty to be neutral rather than partisan arbiters of evidence. In contrast, if elite universities are perceived as biased, much of the data and knowledge flowing from these institutions will be branded as partisan "fake news."

If the United States does not address this deep political division, many of its national efforts regarding vaccination, climate change, inequality, immigration, and even internal, "standard," DEI efforts will fail. They will fail because we will not be able even to discuss these issues and they will all become political and toxic to one side or the other.

MIT and other progressive institutions cannot remain blue islands in a red sea in which pounding waves of divisiveness erode all that MIT, universities, and the U.S. have fought to build. I hope MIT will lead the way with this new Institute-wide and academia-wide initiative to build a more inclusive America for all.

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What's In a Name?

Robert D. van der Hilst
(alphabetically)
Aarti Dwivedi
Jennifer Fentress
Bradford H. Hager
Deepa Rao
Kasturi Shah
Susan Solomon
Lily Zhang

THIS ISN'T A BUSINESS-AS-USUAL donor recognition story. The Department of Earth, Atmospheric and Planetary Sciences (EAPS) is of course delighted to acknowledge Shell for making a gift to support the renovation of MIT's 54-100 lecture hall, which is housed in the Cecil and Ida Green Building (Building 54), our primary campus home. But perhaps even more, we're delighted and proud to announce the name for this space – the *Dixie Lee Bryant (1891) Lecture Hall* – and to tell the remarkable story of the significance behind that name and how it came to be.

In 1891, Dixie Lee Bryant became the first student to receive a Bachelor of Science from the newly-established Course XII at MIT – a milestone that in and of itself warrants commemoration, and one which started the trail for generations of women in geosciences at MIT to follow. And yet, the decision to ultimately recognize Bryant as a pioneer didn't follow a standard course. The story unfolded as MIT's practices surrounding donations were being called into question. While Institute-level committees worked to define values, principles, and processes concerning gifts, EAPS, too, found itself reckoning with tough questions from the community around giving. This is a story about the importance of listening, engaging in inclusive dialogue between donors and departments about shared goals and values, and being willing to course-correct. It is also a success story (resulting in the first major MIT venue named after an alumna) which we hope will inspire colleagues at MIT (and other institutions) to engage with their communities as they consider naming gifts.

First, Some Context

Renovation of the 54-100 lecture hall is part of a larger Building 54 capital renewal project, which includes a prominent 12,000-square-foot addition right in the heart of campus. The vision for this "Earth and Environment Pavilion" is to create a vibrant center for Earth systems, climate science, and related topics, that will welcome students and scholars from across the Institute. Including the 54-100 renovation brought substantial advantages for the design and integration of these spaces and for realizing the project's fundraising goals. To that end, Shell's investment to renovate 54-100 helped EAPS to achieve both the pavilion's mission for education and collaboration and get the overall green light from MIT.

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New Space, New Name

This gift provided a naming opportunity, and in August 2019 a news story suggested that 54-100 be named the "Shell Auditorium." Although no decisions or proposals to that effect had been made or presented to MIT's Building Committee, the idea of having a prominent space in the Green Building named after a fossil fuel company triggered a strong reaction from students and other members of the EAPS community who felt that it was inconsistent with what the department stands for. What would it imply about us as a leader in climate science?

In response, Rob van der Hilst, EAPS department head, called a town hall to open a conversation about EAPS fundraising activities, including the decision to accept the Shell social investment grant. Recognizing that community input and values needed greater consideration in the decision process, Van der Hilst raised these concerns with the Shell team. This marked the start of a constructive, at times difficult, but always respectful dialogue about the symbolism and expectations of space naming and the values and visions of both organizations.

The Challenge

On the one hand, we recognize that past actions of many fossil fuel companies have had negative ramifications for Earth's climate, local environments, and climate policy. On the other hand, we are encouraged by the promises that major energy companies are making to advance a green energy and a carbon neutral future, Shell chief among them with its recently announced goal to reach net-zero emissions by 2050. Meeting that goal and moving toward sustainable fuels and

continued on next page

What's In a Name?
Van der Hilst et al., from preceding page

economies on a global scale, in view of a growing population, and doing it with the urgency that is required, is an enormous task. In our view – which is consistent with MIT's position – finding realistic energy and climate solutions will require the capital, know-how, infrastructure, and global reach of forward-looking energy companies as well as the intellect and creativity of universities like MIT.

Energy companies have partnered with MIT for decades on research and support for students, helping to develop next-generation energy technologies while enhancing our understanding of Earth systems, and propelling the careers of future leaders in science and engineering. Shell and MIT are working on several energy and climate-related initiatives, focusing both on technology and potential scenarios for a future that meets the Paris Agreement goals. However, sponsoring research is different than naming a campus space, and Shell representatives agreed that including the company name would not achieve its intended goal, that is, inspiring new generations of students in STEM fields, especially those interested in working together to tackle climate change. Moreover, it risked distracting from the larger goal of constructive engagement between Shell and MIT on the ambitious agenda of creating pathways – in fact, *speedways* are needed – to low carbon economies. Ultimately, innovation and capital are required right alongside trust and collaboration between academia and industry – themes that came up frequently in conversations with Shell and the EAPS community.

A Community Solution

In September 2019, we began working with the Shell US External Relations team in Houston to find a solution for a naming that recognizes the company's generous support and aligns with the missions of both organizations. Engagement with MIT leaders (including Vice President for Research Maria Zuber, MITEI Director Robert Armstrong, and ESI Director John Fernandez) and with EAPS faculty and a group representing students and postdocs (including organizers of a teach-in on "greenwashing") yielded fruitful suggestions that all parties could feel good about.

Dixie Lee Bryant

In February 2020, it was jointly decided that Shell would retain the right to name the lecture hall but that the choice of the name would be determined by a transparent, department-wide process, reflecting current community values. Given our shared dedication to scientific research and education for a better world, Shell suggested a public "contest" to solicit names that reflect innovation and vision in the geosciences, energy technology, or STEM education. Names celebrating unsung heroes of EAPS, especially women or minorities who made important contributions but had not received the deserved historical recognition, were encouraged.

In consultation with Shell, an ad hoc committee consisting of EAPS faculty, postdocs, and students defined the guidelines for a three-phase naming contest:

Phase I: Nominations were solicited from the EAPS community, including alumni;

Phase II: The nominations were announced and discussed (online) by EAPS students, researchers, faculty, and staff, and the top seven were determined by ranked-choice-voting (RCV);

Phase III: Through discussion and RCV, a committee of five EAPS and two Shell representatives narrowed the list to three finalists, which were then submitted in order of preference to Shell and the MIT Building Committee for vetting and approval.

This process raised awareness of EAPS history and captured the input of more than half of its current community. Alumni, students, faculty, researchers,

continued on next page

What's In a Name?
Van der Hilst et al., from preceding page

and staff alike were able to see their ideas reflected in the process and, in turn, became more invested in the outcome – that is, a lecture hall name of which everybody can be proud. As a student who originally voiced objections to the gift wrote, "Congratulations to the team who worked so hard and volunteered so much of their time to come to a decision that clearly demonstrates the values of the department."

Dixie Lee Bryant (1891), Trailblazer

Dixie Lee Bryant came to MIT from Tennessee in 1887 as one of the first recipients of a Joy Scholarship, established in 1886 by Miss Nabby Joy (a Boston philanthropist) "for the benefit of one or more women studying natural science at the Institute." After completing her degree in 1891 with honors (studying the fossil record of the Charles River Basin), she became a charter member of the faculty and head of the science department at the North Carolina Normal and Industrial School for Women (now UNC Greensboro), where she established what one would now call a STEM curriculum. In 1901 she took a leave to pursue doctoral studies, earning a PhD in geology in 1904 from Friedrich-Alexander-Universität Erlangen, Germany – the first PhD awarded to a woman by the school. (Notably, this occurred almost 20 years before MIT granted its first PhD to a woman.) Bryant returned to the Normal School as its first PhD-holder, but her status and salary remained less than her male colleagues. Soon after, she moved to Chicago, where she taught high school science until her 1931 retirement. Her drive to achieve and her contributions to education are all the more impressive in light of women's status at that time.

MIT has been a pioneer in educating women in technical fields since the 19th century – starting in 1873 with Ellen Swallow Richards, its first female Bachelor of Science. The geosciences at MIT were no exception, although initially progress was slow. It took almost 40 years after Bryant's graduation for Frances Parker to become Course XII's first woman to earn a master's degree, in 1930. Katharine W. Carman followed in 1933 with the first doctoral degree awarded to a woman in Course XII, and it took over eight decades after Bryant for a woman (Dr. Eugenia Kalnay) to be appointed, in 1975, as a faculty member in the department now known as EAPS.

MIT has been a pioneer in educating women in technical fields since the 19th century – starting in 1873 with Ellen Swallow Richards, its first female Bachelor of Science.

Although much work remains to be done to achieve the desired systemic change, at the contemporary end of this history, EAPS women continue to break glass ceilings. Former EAPS professor Marcia McNutt became the first woman to lead the US Geological Survey, in 2009, and the first woman to serve as President of the National Academy of Sciences, in 2015. MIT Vice President of Research and E. A. Griswold Professor of Geophysics Maria Zuber became the first woman to lead a NASA space mission, in 2011, and just this year she became the first woman to co-chair the Presidential Council of Advisors on Science and Technology. In 2018, Susan Solomon, the Lee and Geraldine Martin Professor of Environmental Studies, became the first woman to receive the Swedish Academy's Crafoord Prize for Geosciences.

The Dixie Lee Bryant (1891) Lecture Hall is an overdue recognition of women in science at MIT, and we anticipate hers is just the first name among many who will be memorialized across campus in years to come – a fitting tribute to her status as trailblazer, and one which we hope will inspire future generations of MIT students.

Acknowledgements

In closing, we would like to thank Shell for their generous grant, and the Shell team (including Dirk Smit, Lauren Meadors, Akilah Leblanc, and Julie Ferland) for their openness and active participation in this inspiring example of donor engagement. In equal measure, we thank EAPS students Catherine Wilka, Mara Freilich, Julia Wilcots, Henri Drake, and Tristan Abbott for their voice on climate change and community values, and for their help in turning this opportunity from concern to success. We thank Angela Ellis for helping to reach the fundraising goals for this capital project, and MIT's Resource Development Office for input to an earlier draft. Finally, we thank the larger EAPS community who participated in the naming process – students, staff, postdocs, research scientists, faculty, and alumni – for their thoughtful engagement and insightful feedback.

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letters

Questioning the Merits of President Reif

To The Faculty Newsletter:

I AM WONDERING WHETHER others share my feeling that it is time to replace MIT President Leo Rafael Reif. From a purely financial perspective, Reif has done a splendid job. Under his leadership, the MIT endowment reached $18.38 billion in the fall of 2020, and so nobody can question his ability to deal with donors, no matter how unsavory some of them may be. Of course, his success has required him to occasionally reward donors in questionable ways for their generosity. One such reward being his appointment of David Koch as a lifetime member of MIT's Board of Directors.

I do not know Reif personally. The one time that I saw him, he was pretending to listen to the concerns that the Mathematics Department had about the Schwarzman College of Computing. He deftly avoided addressing those concerns and politely excused himself as soon as he felt he had expended sufficient time on that charade. I have difficulty deciding what sort of person Reif really is. Is he the hard-nosed character who has no compunctions about breaking bread with the likes of the Koch brothers and Blackstone's chairman Schwarzman, or is he the bleeding heart nanny who barrages the MIT community with comforting notices whenever there is a disturbing event that he thinks we are emotionally incompetent to handle on our own?

Maybe he is both, but he isn't the creative leader who will prepare MIT for its role in the mid-21st century. At the time when MIT was searching for President Gray's successor, a concerted effort was made to choose a president with the imagination to envision the demands that MIT would have to face if it were to maintain its standing as a foresighted leading center of science and technology. The list of finalists for the job was impressive. Even though none of those on that list ended up in the president's office, Charles Vest, the man who did, moved the Institute in the right direction when he oversaw the creation of the Department of Brain and Cognitive Sciences. As distinguished from the creation of the Schwarzman College or the Koch Cancer Center, this was not simply an exercise in gilding a lily for which MIT's superb Biology Department was already famous, it was a courageous and educated guess about direction in which biological sciences would go.

I believe that MIT should once again make a search for a leader with that kind of courage and imagination.

Dan Stroock
Professor (Post Tenure)
Department of Mathematics

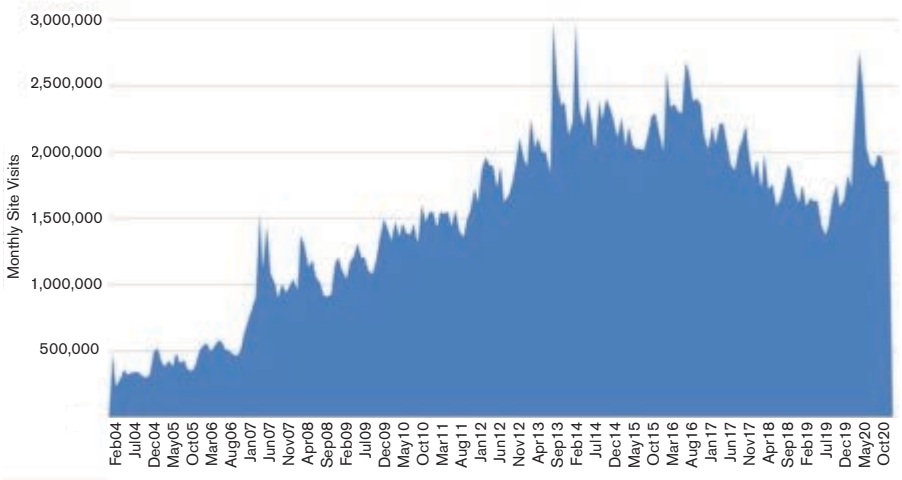
On the 20th Anniversary of OpenCourseWare: How It Began

Hal Abelson
Shigeru Miyagawa
Dick K. P. Yue

ON APRIL 4, 2001, MIT PRESIDENT Charles Vest announced that the Institute would make course material from virtually all undergraduate and graduate courses "accessible to anyone anywhere in the world, through our OpenCourseWare initiative" (Vest 2004). The decision defied the dot-com trend in academia at the time and garnered a front-page story in the *New York Times*. Today, MIT OCW offers high-quality educational materials from more than 2,500 MIT courses – the majority of the MIT graduate and undergraduate curriculum, spanning all five MIT Schools and 33 academic units. One million unique users from every corner of the globe visit ocw.mit.edu each month (see figure), making it one of the largest online educational sites in the world.

In the beginning, OCW was "just an idea – an informed leap of faith that it would be the right thing to do and that it would advance education" (Lerman 2004). OCW had a humble beginning in a small faculty committee formed in the summer of 2000 to develop a proposal for financially sustainable online course dissemination. The idea of giving away the course material was not even remotely part of the group's charge.

What happened that led the committee, at the very last moment before the report deadline, to advocate for openness, and how this idea took on a life beyond anyone's wildest imagination, is a study in how an academic institution can tap the talents of its faculty, delve into its values, and exercise academic leadership to forge an innovation that, in tandem with the technological and societal forces of the time, takes on global significance.



Monthly visits to the MIT OpenCourseWare (OCW) website, February 2004–October 2020

Why Openly Share Teaching Materials?

Shortly after the announcement, a faculty member told us, "The day MIT announced OCW was the proudest day of my career at MIT." This sentiment was shared across the Institute and led to a vast majority (as high as 75 percent) of tenured and tenure-track faculty contributing their teaching material to OCW (Abelson et al., 2012). It is not surprising that the idea of openness resonated with the MIT faculty – sharing knowledge is a core value of the Institute, as articulated in the MIT mission statement[1]:

The Institute is committed to generating, disseminating, and preserving knowledge, and to working with others to bring this knowledge to bear on the world's great challenges.

MIT traditionally fulfilled this mission largely through basic research. Now OCW also substantially supports the mission.

The committee that proposed OCW explored a number of possibilities. Having failed to come up with financially viable and exciting e-learning options for MIT to pursue, the members reached deep into the school's core values and hit on the idea of opening up the Institute's teaching materials. When asked why MIT decided to give away the teaching materials for free, Charles Vest said:

"When you share money, it disappears; but when you share knowledge, it increases."

This captures the essence of OpenCourseWare and celebrates the principle of openness that is at the core of MIT's mission.

1 Available at http://web.mit.edu/facts/mission.html.

continued on next page

20th Anniversary of OpenCourseWare
Abelson et al., from preceding page

Origins of OCW

The emergence of the World Wide Web coupled with the dot-com frenzy of the 1990s sparked a boom-town atmosphere among leading universities, stimulating ambitious ventures in distance education. Some of these were UNext (which began work with Stanford, Chicago, Columbia, and CMU), Pensare (Harvard Business School and the Wharton School of Commerce), Caliber Learning (Georgetown, USC, Wharton, and Johns Hopkins), the Princeton-Oxford-Stanford-Yale Alliance for Lifelong Learning, Columbia's "Fathom" Knowledge Network for online learning, and e-Cornell. e-Cornell is the only one of these ventures that survives today.

MIT, not immune to these currents of change, commissioned several strategy councils to chart a course through the murky future. These included the "Committee on Education via Advanced Technologies (EVAT)" (1994-1995), the The (First) Council on Educational Technology (1995-97), and the Task Force on Student Life and Learning (1996-1998).

The final committee reports revealed two very different visions. On the one hand, there was the promise of expanding MIT education worldwide, "the death of distance" as the EVAT report trumpeted. On the other, there was the Task Force's thorough endorsement of the essential role of informal education and the residential campus as an essential environment for student life and learning, and a vision of the future where

"MIT will continue to attract the best students, faculty and staff by offering an exciting mix of excellent educational and research activities that take place within a residential campus community" (MIT Task Force on Student Life and Learning, 1998).

Faced with this divergent guidance, the MIT administration chartered another task force, the (Second) Council on Educational Technology, to seek a synthesis. The goal of the Council would be "to enhance the quality of MIT education through appropriate application of technology, to both on-campus life and learning and through distance learning" (MIT News Office, September 29, 1999).[2]

The Council was co-chaired by Provost Bob Brown and Computer Science Professor Hal Abelson. It chose to work with an outside consulting firm, McKinsey and Company, in defining and evaluating MIT's strategic options in a changing educational environment. The idea of working with an outside consulting group was suggested by Sanjay Sarma's partner, Dr. Gitanjali Swamy, who worked for Booz Allen Hamilton. In Sarma's discussions with her about MIT, she convinced him that getting a professional consulting team to do an MIT-wide strategic plan, pro bono, would offer a better perspective. At the end of a three-month engagement, the MIT-McKinsey team had outlined a few strategic themes for possible implementation. It chose the banner of lifelong learning and recommended that MIT undertake a study to launch "Knowledge Updates," mini-courses based on MIT's strength in cutting-edge science and technology, designed for MIT alumni.

In April 2000, Provost Brown created the Life-Long Learning Study Group, led by Associate Dean of Engineering Dick Yue, charged with formulating a plan for "Knowledge Updates," with up to $2 million in startup investment to launch an enterprise that should be financially self-sustaining within two years (Abelson, 2008). Shigeru Miyagawa was a member of this group. The group chose to engage Booz Allen Hamilton to conduct a detailed analysis of options and business plans for the proposed initiative. Given the specific charge, this group pursued the Knowledge Updates project with the genuine hope of creating a successful enterprise.

By fall 2000, with the deadline for a final report looming, the group was ready to recommend the rollout of MIT Knowledge Updates (KUs), which, thanks to the support of Booz Allen Hamilton, was backed up by extensive market survey and analysis and a detailed financial model. The proposal was that, in order for a meaningful impact and reasonable chance of financial sustainability in the near future, MIT needed to pursue KUs at a significant scale at the Institute level. Some in the group, including Miyagawa, had expressed concerns about KUs from early on. There were many risks and unknowns: Would the venture divert resources from MIT's core mission? Would it dilute MIT's brand? Would this negatively impact the Institute's culture and faculty unity? Given the late start relative to many of our peer institutions in this space, what were the chances that we would be successful? These and other questions were discussed extensively in the group's final deliberations.

After months of strenuous work, what was on the table was reasonable but far from spectacular. Many on the team had harbored aspirations that this could be a unique opportunity for MIT to exert leadership, set an example for its peers, and make a truly significant impact. In contrast, the KUs struck them as underwhelming. It was against this backdrop that the idea of OCW was born and took hold. In one of the last meetings of the group in October 2000, Yue laid out the basic idea that MIT could aim for leadership and impact by simply giving away all the teaching material without charging for it. That was to be the recommendation to MIT and that MIT would make an institutional commitment to making this happen. The idea was remarkably simple and could be articulated succinctly. Once understood and embraced by the group, they quickly worked out some of the key issues and prepared the final recommendations and report, which followed essentially what was originally proposed in that October meeting. They came up with the name *OpenCourseWare*, drawing both the

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2 "Provost announces formation of council on educational technology," MIT News, September 29, 1999. Available at http://web.mit.edu/newsoffice/1999/council-0929.html.

20th Anniversary of OpenCourseWare
Abelson et al., from preceding page

name and inspiration from an earlier MIT effort, open source software.

OCW Is Born

In October 2000 the Life-Long Learning Study Group presented its report to the Academic Council. The report contained a treasure trove of data gleaned from interviews with 50 external organizations engaged in e-learning, responses to an extensive survey sent to 2,500 alumni (deemed potential clients for Knowledge Updates), interviews with 60 MIT faculty members who had already put their teaching materials on the Web, and a series of elaborate business models, all done in collaboration with a team from Booz Allen Hamilton. The report included – "almost as an afterthought" (Abelson, 2008) – the following suggestion, fundamentally defying MITCET's original charge to the group:

A revolutionary notion of OpenCourseware@MIT could radically alter the entire lifelong learning and distance learning field and MIT's role in it and should be seriously considered.[3]

Guiding Principles and Institutional Leadership

The committee agreed on a principle that became a cornerstone of OCW: all materials offered should be cleared of copyright so that users can freely use them to learn and to teach. When Harvard Law professor Larry Lessig and his colleagues launched Creative Commons in 2001 to furnish licenses for appropriate use of copyrighted material free of charge, MIT OCW adopted this mechanism for virtually all its materials. Abelson, who was part of the group that launched Creative Commons, worked between the two nascent initiatives to arrange the license adoption. OCW became the first institutional project to use Creative Commons licenses. Conversely, several OCW requirements helped shape the terms of the newly minted Creative Commons licenses.

The principle of faculty governance was central to the planning phase of OCW. Chancellor Larry Bacow told the OCW planning group that MIT could not announce the initiative without extensive discussion within the community. The group met with 33 departments and major administrative units. Although most voiced support, some raised concerns, such as the risk that OCW could devalue MIT's reputation by putting up low-quality material (Abelson, 2008). The culmination of these discussions was a presentation at the February 2001 faculty meeting, at the end of which President Vest spoke with conviction about OCW. The record of the faculty meeting states that, noting the trend toward commercialism in higher education,

MIT could be a disruptive force by demonstrating the importance of giving information away. Vest noted that in the 1960s and '70s MIT had a big impact on education, not only from textbooks that were published by the faculty but also from the course notes, problem sets, and other materials our graduates took to other institutions where they used them in their teaching. OCW, he stated, gives us another chance to make such an impact.[4]

Thus, while faculty governance was at the heart of decision-making that moved the initiative forward, academic leadership played an equally important role, and MIT was blessed with strong and open-minded leaders. The role of President Vest was obviously critical. Others who played a key role in guiding OCW went on to leadership positions at major universities. Provost Brown, who shepherded the discussion from the outset, became president of Boston University in 2005. Rafael Reif, who took over as provost after Brown and continued to nurture OCW, became the 17th president of MIT in 2012. Chancellor Bacow, who called for the extensive discussions to get as many on board as possible, became president of Tufts University in 2001 and of Harvard in 2018.

Off and Running: Funding, Staffing

Funding

Giving away the course material for free does not mean that there is no cost to set it up and operate. Fortunately, Vest's overture to William Bowen, president of the Mellon Foundation, was met with enthusiasm. Bowen in turn contacted Paul Brest, president of the Hewlett Foundation, and the two foundations agreed to fund OCW. Ira Fuchs, the Mellon Foundation program officer for the grant, said that the foundation "really bought into the ambitious and unique nature" of OCW (Walsh, 2011, p. 62). Without this generous funding, OCW would not have seen the light of day.

Staffing and Implementation

Once the grant proposal to Mellon and Hewlett (co-authored by Brown, Abelson, and Faculty Chair Steve Lerman) was approved and an initial $11.5 million awarded, Anne Margulies, former CIO of Harvard, was hired in May 2002 as OCW executive director. Her first task was to create a 50-course pilot by September of that year (Walsh, 2011). She recalls, "All eyes were on us. There were lots of skeptics, but the overwhelming majority were excited."[5] Margulies participated in the 2002 UNESCO Forum on the Impact of Open Courseware for Higher Education in Developing Countries, held in Paris. Many university presidents and rectors from developing countries were in attendance, and their message was "Thank you, MIT."

In addition to creating a 50-course pilot in her first four months, Margulies had to complete posting 500 courses by October of 2003. This deadline, imposed by the funders, had to be met before delivery of the balance of funding. To the credit

continued on next page

3 Lifelong Learning Study, Summer 2000. Report to the MIT Academic Council Deans' Committee, October 17, 2000 (unpublished).

4 MIT Record of the Faculty Meeting of February 21, 2001. Online at https://web.mit.edu/dept/libdata/libdepts/d/archives/facmin/010221/010221.html.

5 Interview with Margulies on March 7, 2016.

of Margulies and her team, which at the peak numbered 50 full-time employees and outside consultants (Walsh, 2011), the deadline was met and Hewlett and Mellon awarded the remaining $16 million, which made it possible to complete the OCW posting of 1,800 courses by 2007.[6]

Margulies left in 2007 to become assistant secretary for information technology and CIO for the Commonwealth of Massachusetts; since 2010 she has been vice president and University CIO at Harvard. Cecilia d'Oliveira, who had been the director of technology for OCW, took over, overseeing continued growth with new programs like OCW Scholar courses and OCW Educator. After her retirement in 2018, Curt Newton, a long-time member of the OCW team, was appointed as director.

Impacts at MIT

OCW has significant and beneficial impacts on campus at MIT. Students use OCW resources such as problem sets and exams for study and practice. Freshmen report that they checked out the school by looking at OCW before deciding to apply. Because faculty have easy access to the course material that their students use in other courses, OCW serves as a broad communication channel among faculty. And alumni access OCW materials to pursue lifelong learning.

MIT has also benefited from the attention it has received. A large number of media outlets from around the world have featured OCW. For example, *Wired* (Diamond, 2003) reported that, before OCW,

no institution of higher learning had ever proposed anything as revolutionary, or as daunting . . . . MIT earned the distinction as the only university forward-thinking enough to open-source itself.

[6] This was the original target, and was celebrated at the time (https://www.youtube.com/watch?v=tbQ-FeoEvTI).

Global Impacts

For users in developing regions of the world such as sub-Saharan Africa where Internet access is cost-prohibitive, unreliable, or nonexistent, OCW helps to bridge the "digital divide" through its mirror site program on external drives, and there are more than 430 of these sites.

Through the regular OCW site, YouTube, and these mirror sites, over 200 million people have accessed the content more than 500 million times. Many (50 percent) are students at other institutions, both college and pre-college, and others are "self-learners" looking to enrich their professional and personal lives (45 percent). As an example of self-learners, Jean-Ronel Noel and Alex Georges from Haiti wanted to develop solar panels for their country but needed guidance in electrical engineering. They found it through OCW. Noel told the OCW staff,

I was able to use OCW to learn the principles of integrated circuits. It was much better than any other information I found on the Internet.

Their company, Enersa, has made solar-powered LED lighting available in almost 60 Haitian towns and remote villages (d'Oliveira et al., 2010).

While teachers currently account for five percent of those who access OCW, their use has a multiplier effect when used with their students. Educators have described a variety of ways in which they incorporate OCW material into their classes. For example, Triatno Yudo Harjoko, head of the Architecture Department at the University of Indonesia, said that to redesign the curriculum he and his colleagues turned to MIT OCW as an immense comparative database (d'Oliveira et al., 2010):

We try to understand how the courses are formulated and what the expected outcomes are. This gives us an important perspective on the learning process.

Concluding Remarks

OCW was transformed from an informed leap of faith to a functional enterprise that serves learners all over the world and returns benefits to MIT. It is a "bold creation" (Bowen, foreword to Walsh, 2011) that changed the equation for e-learning from the obsession with commercialism of the dot-com era to a demonstration of the enormous value in freely sharing knowledge produced by an academic institution. The one million people who access OCW every month illustrate the demand for high-quality teaching materials among students, self-learners, and educators. As we live through the pandemic, resources such as OCW have become even more valuable, leading to a 60 percent increase in website visits from all over the world during the peak quarantine period of April-May 2020.

OCW moves into its next 20 years with a renewed commitment to share the MIT curriculum with vibrancy and currency as it evolves, highlighting materials on big themes like the future of computing, sustainability, and social justice. A new platform currently in development will better support learners on mobile devices and those with sporadic Internet access, substantially enhance the search tools millions of learners use to find learning opportunities, and foster greater adoption and adaptation of OCW materials by educators in their teaching. And, OCW looks forward to prioritizing collaborations with others in the broad OER ecosystem (that OCW itself played a role in seeding) to build greater educational equity, through adapting and customizing content to meet the needs of specific learning communities. In all these ways and more, MIT is building upon OCW's 20-year foundation of unlocking access to knowledge.

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Education for Non-Robots

Luis Perez-Breva

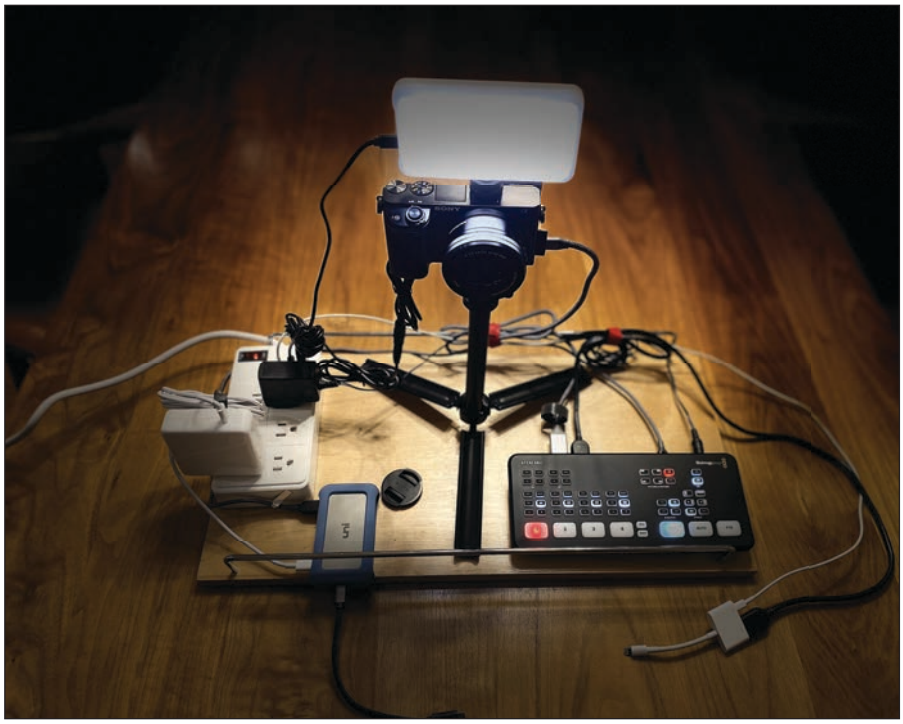
I JOKINGLY CALL WHAT YOU SEE in the photo the "derobotizer" setup (more on that below). I made it for my wife after the pandemic forced her to shift to working mostly online via Zoom – like all of us educators. She happens to be a biotech executive.

This setup is about as portable as it gets. I hooked it up in minutes using off-the-shelf parts on top of a tray serving as the base. It's easy to use, makes you look like a real person on any video-conference app, and allows you to perform serious remote-world magic. Anyone can set it up.

I think every *committed educator* needs something like this. Below, I offer some no-frills instructions for creating your own professional remote derobotizer setup – or you can go even further with the derobotizer I made for myself. But first allow me to explain why and how I got to the point of derobotizing in the first place and why I think educators will need to master this new medium in the "new normal" that follows the vaccine rollout.

It begins with the meaning of technology. This has nothing to do with pretend-playing with a product, or enslaving users for advertising dollars. I set out to solve a *problem*, and technology was a *tool* to begin to solve that problem in the very way MIT founder William Barton Rogers intended – to extend our power over nature. In this instance, it was to extend our (humans') power over nature just enough to overcome pandemic fatigue, and perhaps help students find solace in their education.

You don't need to settle for the robotic, pixelated version of yourself the pandemic has cornered you into becoming. You *do not* need thousands of dollars, specialized knowledge, minimum-viable startup-oil, or some youth potion. Indeed, you can get started right away.



The No-Frills Derobotizer

I worked my way to a home video setup that allows me not only to show slides but hold them in my hands and point at them with my fingers while my students – in real time – see slides magically change and experience the same awe Harry Potter did the first time a moving picture winked at him. I learned new tricks as I strived to adapt my teaching, management, and presentation routines – as evidenced by the "magical slide" employing a trick that I used in the classroom and in conferences such as my keynote presentation at the 2021 KEEN National Engineering Unleashed conference.

Technology in Service, not Hindrance, of Humans

Lecture 1, I pulled up my slides, turned my head, and discovered the classroom – and all my students – had disappeared. About 40 humans had just dropped from my sight and all I saw was Catalina Island. I knew I had to keep my cool.

In 2020, all the tools, labs, experiences, and whatnot we educators have honed to shape minds stopped working. Overnight,

continued on next page

Education for Non-Robots
Perez-Breva, from preceding page

the need for Zoom created all manner of cognitive traps, including my students' disappearing act. Many of us transformed into robotic-sounding, pixelated versions of our former selves (hence my use of "derobotizer"). It's as if we woke up one morning to Plank's constant suddenly becoming 1 (ask a physicist friend about that).

If your experience was anything like mine, the sum total of the advice you got about making this profound shift was to avoid putting yourself in front of a window, lest your students take you for the silhouette of some confidential informant in a made-for-TV crime documentary – in other words, nothing to prepare you for the new reality-shattering normal of things.

Truly *educating* someone takes more preparation than most of us admit to ourselves. Preparing and delivering an engaging, rigorous educational experience requires enormous brainpower to gauge the audience in real time, keep its attention, and be ready to react to wherever the conversation may take you while still hitting all the main points. You have to be prepared to handle whatever *might* unfold in the multiverse. No two cohorts are the same, and any two editions only resemble one another. Whether you call it education, mastery experience, or flipped classroom, it takes a fully engaged human brain, not a parrot. That's why merely surviving Zoom is no replacement for education. The fact that so many think it might be reveals that we may have begun to go full-on robotic well before bats brewed Covid-19.

We've been getting a sneak peek into the despair, boredom, confusion; atrophied critical thinking, addiction to good-sounding recipes, and general loss of nuance that begets a world in which education is flat, abstract, pixelated, and cursed to a daily face-off with other screens – a world devoid of actual education, and where instead it feels as if everything's become marketing or branding.

Some Starting Principles

I wanted a teach-from-home studio without going overboard and spending a fortune – like this University of Tennessee professor did. I wanted to start with whatever I already had, make the most of it, and figure out what else I might need as I went along. Several principles guided me.

- Your laptop or phone is like a one-person band: impressive, but no match for an actual band So, invest in separate hardware.
- My students and I can only share the same reality if we see the same thing. When teaching remotely, you also supply the "real world" (classroom, breakout rooms, and all that students perceive about the class). Sacrifice quality and you degrade reality for everyone.
- Computers are dumb. Tell it you have a green screen. and it will replace anything green with your choice of background. Use this to create magic.
- The bigger the screen, the less you need to think outside the proverbial box.
- It's easier to lead when you are standing up.

These principles were enough for me to think through the entire setup I built for myself over the fall semester, and eventually led to the specifications for the "derobotizer."

Sadly, the pandemic has also made it easy to imagine learning minus the teacher and the action – perhaps with a recording, some app, this or that masquerading as "AI," and peer-grading. Education administrators have turned to anything labeled "Ed Tech" to appease their boards. We risk losing the meaning of education to the same breed of opportunists turned startup-oil salesman that would advocate the kind of minimum viable "tech for education" that will "help" education just the way "social" media made us more "social."

I know my students appreciated the commitment to education more than they would have accepted the justifiable excuses had I made them. The lesson: this is no time to take education for granted. It *is* the time to double down on every reason we still call it educating (not just certifying).

Pretending Reality Hadn't Been Distorted Is Futile, So Distort Your Own Reality

Back to Lecture 1. I'm still watching Catalina Island. The next few seconds would be crucial. The classroom didn't *really* disappear; rather, because I shared my slides, the Zoom window with students had hidden itself somewhere. To my dumbfounded brain, though, busy choreographing my teaching act, the entire episode felt pretty much as if an actual physical classroom had disappeared.

I should mention that my class is particularly unsuited for this remote world – or so I thought. It is deeply experiential, based on research, open ended, and combines teamwork and lectures. I designed and run it as a mastery experience, with a flipped classroom pedagogy. It is also a truly cross-discipline, cross-School elective (my students come from all over MIT and Harvard). We take technology advances and papers and ask ourselves the tough questions: Now that we know *that is* possible, what problem can we solve that we couldn't before? What will it take to assemble and fashion the technologies and organization to do it sustainably? You can learn all about it here.

Students who take my class sometimes come to dread that I refuse to give them a recipe. Those that persevere end up thanking me for liberating them from the

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Education for Non-Robots
Perez-Breva, from preceding page

childish recipes and slogans that populate the conflation of entrepreneurship and innovation that has taken over academia. I cannot afford a bad performance early on, though; my class is an elective – the only way to stay truly multidisciplinary in our modern educational system. If, based on that first encounter, students dropped the elective, I'd forfeit months of work making the class known to students across MIT, which is how I materialize my multidisciplinary mission. Imagine, then, my anxiety over the disappearing classroom.

We were set to work in teams on projects ranging from, among others, quantum computing and obfuscation to biotechnology manufacturing, artificial intelligence, new drug delivery systems, and new battery technologies. I could not imagine leading teams of daring students for an entire semester while in fear of sharing slides. Nor could I imagine surrendering to becoming a voice-over to my slides. After all, education isn't about accompanying my slides or a textbook or a recipe with voice, but about freeing students from the tyranny of recipes and gifting them with increased skills to use their own critical thinking. Right?

I managed that first day, and became better quickly (see some technical guiding principles in the box, opposite). Along the way, I learned to present in a wall, standing up, walking around my slides, and knocking at them to prove my points were solid; present while holding slides in my hands that moved like the paintings in *Harry Potter*; present while seeming to doodle in mid-air; use my iPad as the whiteboard while still showing my camera's image; and countless other tricks, all done from home with a setup like the one in the photo.

That setup (see instructions in the box, opposite) allows you to go back and forth from slide to image with the press of a button. With picture-in-picture (another button), you can display both your camera image and iPad. A tablet pen lets you doodle on your slides.

The No-Frills Instructions for Your Own $1200 (or Less) Derobotizer

You can create your own professional remote derobotizer setup like the one I made for my wife. Here's the equipment to get you going with high-quality video, presentations you can easily control, and a few tricks.

- Sony Alpha 6000 (~$600)
- A live HDMI Switch like the ATEM Mini (~$300)
- Lumacube Broadcast lighting kit ($100)
- USB-C 8-in-1 hub (~$40)
- Apple Ipad AV adapter ($50)
- Micro HDMI Cable ($9)
- Power strip with USB charger ($17)
- Hotshoe to 1/4'' converter ($7)
- Neewer DC Coupler replacement for NP-FW50 (~$30)
- A tablet and a computer (we used a Macbook and iPad we already owned)

Set the camera to movie mode. Plug it into a USB outlet (with the DC power); then connect it to the HDMI switch (with the HDMI cable) and connect the switch to the computer. Your computer will treat any signal it receives from the switch as if it were coming from a webcam. Connect a tablet to the HDMI switch and you'll soon be able to combine the images from your high-quality autofocus camera and your tablet to achieve myriad effects. Indeed, you can show any app from your tablet in your video calls: whiteboarding, sharing websites, PowerPoint, doodling – no need for additional software licenses. Farewell "share screen" button!

Your HDMI live switch can also "project" content from your tablet onto a green screen or even just a green cloth. You can also just hold up green card stock and your audience will see you pointing at your slides. That's what I was doing when someone referenced the paintings in *Harry Potter*.

You can do all this just fine with the no-frills derobotizer. Add bookshelf speakers (~$105) and a high-quality microphone (~$150) to improve your and their audio experience.

If you strive for interactivity, you can greatly simplify your teaching workflow with additional screen real estate. I found myself expanding beyond two screens (laptop and iPad) with displays already lying around. I dedicate one to my audience and one to the chat and participants windows. I use my laptop's screen for notes I might need to consult while presenting, and I present content from my iPad. This helps me focus on teaching. After I ask a question, I quickly glance at the participants' window screen and see whether anyone raised a hand or wrote in the chat. And no humans ever disappear!

I procured most of the materials for my wife's setup from B&H Photo, Hunt's Video, Amazon, and Keh Camera. Maybe you already own a mirrorless camera or other equipment you can use.

Sure, you can do all that on Zoom, too. It's also true that with enough patience, you may be able to cut a small tree by chewing at it, although I don't recommend that. Technology isn't only about doing new things; it's also about making complicated stuff easier to handle, which this setup accomplishes, so you can focus on teaching and learning – the important stuff.

Pushing the Limits of the New Reality for the Sake of Teaching and Learning

With the newfound confidence that comes from knowing the classroom wasn't going to disappear again, came an opportunity to learn how to educate online.

continued on next page

Education for Non-Robots
Perez-Breva, from preceding page

I discovered that structuring my content by weeks rather than modules or individual lectures helped students measure progress and overcome more easily the disorienting nature of living in confinement. This required I rewrite my syllabus but also helped me prepare to react to where students are in their learning and coping – we all get hopelessly lost online, so reminding students every other week where we were in the class helped.

One full hour online carries only about 20-30 minutes of the equivalent in-person content. You need new strategies to convey content. I broke lecture content into 20-minutes-or-less chunks, changing the activity from segment to segment. I created plenty of new breakout room activities designed so the content would emerge through discussion when we reconvened. Students crave interaction, so I used breakout rooms with tactical assignments that helped students share their progress, and meet one another.

I ended up finding a lot of good uses for the Canvas software, particularly the ease with which it creates websites to offload content I might have delivered in person in the past (and thus create more time for interactivity) and, unexpectedly, as a live conference organization/management system.

The home front matters too! I dread the notion that my family could be together at home isolated from one another by a forced addiction to Zoom. I found ways to help my kids help me. I enlisted the invaluable help of my 11-year-old daughter and eight-year-old son, who became my honorary teaching assistants. That, incidentally, was the smartest decision of all. It helped us all fight isolation and insularization together.

I learned also a few things not to do. The immediacy of online polling results can easily kill the conversation. When needed, I poll the old-fashioned messy way. I do not to record live sessions for students; I'm not a parrot, and for me education isn't about giving slides a voice-over but about the interaction – I have a whole different workflow to create recordings. In non-pandemic times, I love when students feel they can drop by with questions at any time (I learned from Patrick Winston). In pandemic times, that meant going beyond Slack and giving my cell-phone number to students. Formal peer-to-peer assessments did not work for me, but giving students a guided opportunity to comment on each other's work worked wonders – provided I did not make it an assignment but an activity.

Learning New Ways

Most often, reality matter-of-factly proves our theories wrong. Sometimes, it shreds a confirmatory data point. I think of what I teach as the practice of how to solve problems that matter starting with what you have, and with technology (new or old) as a malleable tool; that is also the subtext of my book *Innovating* (MIT Press, 2017). I wrote *Innovating* to share how to do just that after decades exploring, testing, refining, teaching, and adapting the subject matter to academia and industry worldwide. That practice helped me and my students in this pandemic.

The student teams worked smoothly, better than in many other semesters – even though the members had never met in person – and so much so that we dared try new things.

At the end, they presented advanced technologies to a middle school Zoom meeting packed with 300 students and faculty in what was a profoundly inspiring event. They glimpsed into a future: colonizing Mars with batteries and bio-manufacturing; quantum computing in space; a game to repurpose technologies and innovate while playing. Without the pressure to pretend-play that everything is a "startup pitch," student teams found genuine ways to explain a future that technology can help build. I now want to end my class like that every year.

Two days later, I closed the first ever homemade remote edition of iTeams – that's the name of the course – by entering a forest that had "magically" grown in a utility closet in my office (you can see a video of it here).

I learned, too, especially about technology simply serving the objective of educating – and that it is urgent we share more broadly our gift for fashioning technology into tools to come to grips with problems that matter.

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