Task Force on the Undergraduate Academic Program Phase 1 Report

This is an exciting opportunity to design the world's greatest undergraduate technical education. How do we do that? We are asking all of you to read this report and the preliminary set of goals, informed by conversations with 30 academic programs and input from hundreds of students, staff, and alumni. In a few short weeks, inspired by these goals, we will challenge you to design what this new educational future for MIT could look like. At that point, any design will be on the table.

This brief report includes an overview of the Task Force on the Undergraduate Academic Program's (referred to as TFUAP here-in) work to date along with a draft set of learning and process goals for the undergraduate educational experience.

We invite members of the community to review the report and to provide their considered and constructive feedback on the goals. Comments can be emailed directly to tfuap@mit.edu. TFUAP will review and consider all comments. A final set of learning and process goals will be released in December 2024.

After we have finalized the goals, we will invite members of the MIT community (as individuals or in groups) to submit white papers that detail plans for curricula, classes, and/or pedagogies that are consistent with these goals. Details and submission guidelines will be included in the call for white papers.

We expect to close the call at the start of the Spring 2025 semester, at which point TFUAP will read and synthesize all submissions and identify multiple possible designs for the undergraduate academic program. Based on the details of the resultant designs, TFUAP will recommend next steps.

It is important at the outset of this report to emphasize that the Task Force has not made any decisions regarding the design of the undergraduate academic program, nor should any of the learning and process goals listed in this report be interpreted as implying a particular design. In drafting the goals, the Task Force has taken care to craft language that is specific enough to inform proposed designs but not so specific as to prescribe a particular design. Put another way, we fully expect and hope that the MIT community will develop a variety of possible methods for achieving each of the goals listed in this report.

Overview

Charge

As issued in January 2024

This Task Force responds to two different but overlapping needs:

- First, the need for a comprehensive regular review of our undergraduate educational program; this need was well articulated seventeen years ago by the Task Force on the Educational Commons (2006).
- Second, the need to educate future generations of leaders, problem solvers, and citizens so that they are prepared and enabled to invent a future that will enhance human life and the life of the planet.

The Task Force will consider all aspects of the undergraduate academic program as areas for potential improvement and revision. Its mandate extends to both curriculum and pedagogy and will encompass both the SME and HASS General Institute Requirements[1] (GIRs) as well as experiential learning. (Areas such as advising and the education of learners outside of MIT should not be considered to be within the scope of the Task Force). Any future vision or proposal will need to embody both changing needs and the enduring, core values that underlie our rigorous educational programs. We will also look to this Task Force and the process of review for lessons that will help us to create an effective template for future educational review and adaptation, including parameters for educational experiments that will enable us to innovate and advance as part of an ongoing change process.

Preparatory work for this review will be undertaken by several Foundational Working Groups that have been charged to report on aspects of the current degree requirements, aspects of current educational policy, and a few additional areas of learning or investigation.[2] Informed by these

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[1] The principal aims of the General Institute Requirements might be stated as the provision of: (1) Foundational Building Blocks: The GIRs provide a common body of knowledge that faculty can then assume in teaching advanced subjects. (2) Literacy in Essential Fields: The GIRs provide substantive knowledge in areas with which every MIT graduate should have familiarity. (3) Methods for Creative Analytical Thinking: The GIRs teach modes of thinking and provide portable (transferable) tools, skills, and general strategies for formulating, analyzing, and solving problems. While these are the principal aims of the MIT General Institute Requirements, the specific subjects and experiences in the undergraduate program that may best achieve these aims have evolved over time. The background, interests, and expectations of our undergraduate students have changed in recent years, as have the fields they will enter, and both pedagogy and the technology available for delivering educational experiences have evolved in important ways.

[2] Three of the Foundational Working Groups will focus respectively on the current state of the SME (science-math-engineering) and HASS (humanities-arts-social sciences) components of the GIRs and the Communication Requirement; these reports will be prepared by the committees charged with overseeing these three requirements. Further foundational work will be provided through three recent reports

reports, the Task Force should also conduct broad outreach to the MIT community to understand the challenges and opportunities for our residential program and to engage the community in this project.

Through its engagement with the MIT community, the Task Force will seek to understand the kinds of preparation our graduates need. Beyond MIT, the Task Force should also consider how our students are being prepared in K-12 education, investigate curricula, requirements, and structures at peer or similar institutions, and incorporate the findings of relevant external studies.

While the Task Force may arrive at its own recommendations and vision, one aspect of its work should be to solicit and evaluate short proposals by individuals or groups within the MIT community, whether for limited or more sweeping changes. The Task Force may wish to request further development of especially promising proposals or to confer with their authors.

Any vision, in order to be implemented, requires consensus. The consensus of the faculty may extend to a modest revision of our educational programs, or it may extend to something more expansive; we would encourage the Task Force to consider both what is achievable and what is imaginable and to engage in ongoing dialogue with the faculty and the broader MIT community as potential recommendations take shape. While a compelling unified vision may emerge, the Task Force may also wish to provide a choice of pathways or a multi-part, phased proposal. The Task Force should also consider mechanisms that would enable limited educational experiments and innovations for assessment and, potentially, broader adoption as appropriate.

Proposals by the Task Force for changes in the undergraduate requirements will be considered by the appropriate committees of Faculty Governance for their consideration; to expedite the process, we recommend regular interaction between the Task Force and both CUP and FPC as these proposals are being drafted. The Task Force report may include proposals for motions to amend the Rules and Regulations of the Faculty if needed for implementation of its recommendations.

Committee Membership

Adam Martin, co-chair, School of Science
Joel Voldman, co-chair, School of Engineering & Schwarzman College of Computing
Kate Weishaar, staff, Office of the Vice Chancellor/Office of Experiential Learning
Esther Duflo, School of Humanities, Arts and Social Sciences
Jeff Grossman, School of Engineering & Schwarzman College of Computing
Isaac Lock, junior, Course 20 & Course 24-1

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reviewed and updated as necessary for the purposes of the Task Force: the reports on Computational Thinking, Social Equity and Civic Responsibility (RIC2), and Lessons from Online Learning. Finally, the Committee on the Undergraduate Program has been asked to prepare a report on policies that shape the current undergraduate program.

Rob Miller, School of Engineering & Schwarzman College of Computing
Bill Minicozzi, School of Science, CUP
Caitlin Ogoe, junior, Course 6-9
Janet Rankin, Teaching + Learning Lab
Skylar Tibbits, School of Architecture and Planning
Lily Tsai, School of Humanities, Arts and Social Sciences
Maria Yang, School of Engineering
Karen Zheng, Sloan School of Management

Process

We have organized the work of TFUAP into three phases, briefly described as follows:

Phase 1: Goals. This phase consists of information gathering and analysis to answer the question "What are the goals of an MIT undergraduate education?"

Phase 2: Design. This phase will focus on generating possible models of the MIT undergraduate program that could achieve the goals outlined in Phase 1. It's useful in this step to allow all possibilities in the possible choice set – everything from no change to complete rethinking of the program. A key component of Phase 2 will be a call for white papers issued to the full MIT community.

Phase 3: Refinement. This phase will focus on iterating and preparing for implementation, including sharing and seeking community feedback on draft designs, refining, and synthesizing designs, piloting and experimenting as appropriate, and finally developing a plan for adoption pending a vote of the faculty.

We are currently near the end of Phase 1.

Phase 1 Process

During Phase 1, TFUAP has primarily focused on listening to the MIT community including faculty, staff, students, and alumni. We have also learned from past reports, external organizations, literature, and peer institutions. Since beginning our work in February of 2024, TFUAP has:

- Held at least 52 meetings with MIT community members including 30 academic programs, 6 School/College councils, faculty committees (FPC, CAP), 8 UG student-facing groups of staff and administrators (UAC, TLL, CAPD, Admissions, UG Acad Admins, Experiential Learning, S^3, DLL) and 6 different cross-sectional groups of students.
- Launched a survey open to all current employees and students to solicit direct input about the goals of an MIT undergraduate education and the strengths and weaknesses of the existing program. Received and reviewed more than 300 responses.

- Surveyed a randomly selected subset of alumni who graduated 5-15 years ago on their perspectives on their MIT education and how various skills show up in their current work. Reviewed 272 responses that were returned.
- Contacted colleagues at 11 peer institutions to learn more about their educational goals and undergraduate curricula.
- Solicited data from the Registrar's Office and other sources to understand actual student behavior and trends over time related to workload, majors, grades, and other topics that arose throughout the listening tour.
- Read and discussed reports from foundational working groups and prior committees tasked with reviewing MIT undergraduate education, in the interest of building on rather than duplicating past efforts. These include reports from CUP, SOCR, the subcommittee on the HASS requirement, the working group on computational thinking, and the SME GIR working group. We also reviewed the 2006 Report of the Task Force on the Undergraduate Educational Commons (*aka* the Silbey Report), and the 1964 Report of the Committee on Curriculum Content Planning (*aka* the Zacharias Report).

Learning and Process Goals

During Fall 2024, TFUAP has focused on synthesizing this input to create a list of nine learning goals and four process goals. We define **learning goals** as outcomes of the MIT education (i.e. what we expect every graduate to be, know, or be able to do) and **process goals** as qualities of the MIT educational experience that should be deliberately supported through policies and pedagogy. Though some learning and process goals are closely related, the task force felt it was important to separate the characteristics of graduates from the characteristics of the MIT experience.

Underlying all our goals is MIT's commitment to excellence and rigor in its undergraduate education. We ultimately aim for an undergraduate academic program that celebrates the qualities that make MIT, well, **MIT**. An academic program that inspires our students and enables our graduates to dream big, innovate, and contribute to their profession and society.

Learning Goals

We have arrived at a set of nine learning goals and four process goals. After gathering extensive community input and data, we have distilled what we heard into a set of nine learning goals and four process goals. To arrive at these goals, we asked each TF member to read through all of the input and independently generate a list of goals. We then clustered these goals, discussed extensively, and sometimes separated or eliminated. **In line with MIT's rich tradition of numbering things, these goals are numbered. Also in line with MIT's tradition of numbering things, the numbers mean nothing and are used purely for efficiency.**

While some of the goals are relevant to many institutions of higher education – after all, we share some common purpose across higher education, some goals are more specific to MIT. More importantly, however, we feel that it is this particular collection of goals and our unique approach to implementing them that is the mark of MIT's distinctiveness.

These goals are intended to guide the design of the undergraduate education program. In Phase 2, we will be undertaking design, using the collection of listed goals to evaluate proposed designs; a successful design exercise will result in an undergraduate educational program that meets all goals. As noted above, **the Task Force has not undertaken any design yet**, and thus, while we intend that multiple designs can meet the list of goals, it is possible that no feasible solution exists, which would require the Task Force to revise some of the goals.

Goal 1

Every MIT graduate will know strategies for managing their time, advocating for and taking care of themselves, and finding fulfillment and belonging in their academic/professional pursuits and personal life.

Both faculty and students shared concerns about the pressures to do too much. Although data from the Registrar shows that registered units have stayed constant over the past 20 years, student responses to the Quality of Life Survey report that they increasingly feel "overwhelmed by all you have to do". Additionally, staff in Student Support Services (S^3) shared that S^3 visits have increased significantly in recent years and have become predominantly urgent needs and walk-ins rather than planned appointments. While some of the increase could be attributed to the COVID-19 pandemic and related challenges, this trend has persisted. Many alumni survey respondents highlighted the need for better mental health support, including addressing the pressure to overwork and sleep deprivation. Despite the overall concerns, some faculty, students, and alumni noted that the high-pressure environment at MIT forces students to learn to abandon perfectionism and figure out their priorities, but they wished that it did not require years of struggling before figuring out a healthy approach.

Goal 2

Every MIT graduate will be equipped to solve problems using fundamental technical ways of thinking, including mathematical, computational, and scientific. Every MIT graduate will share a common base of technical understanding.

It is important to have a common shared base of technical understanding-- a technical canon. This shared base provides MIT graduates with an understanding of science and technology that prepares them to be technically well-informed members of society. We encourage white papers that consider different approaches to this base, including different fields and pedagogy.

The notion of a "common base of technical understanding" is central to MIT's identity as an institute of technology, but we take care to note that technical understanding is insufficient to be effective in any role (technical or otherwise) in the 21st century. Other types of understanding will be addressed in subsequent learning goals.

The different ways of thinking serve as a foundation for pursuing a variety of fields of study at MIT. Mathematical thinking includes but is not limited to symbolic modeling and solution; and continuous modeling and solution. Computational thinking includes but is not limited to discrete modeling with computational manipulation; and abstract modeling with proof. Scientific thinking includes but is not limited to scientific method with hypothesis, experiment, and data collection; and statistical modeling and solution. Scientific disciplines also have other ways of defining problems and creating models and solutions. Though we explicitly call out these particular mathematical, computational, and scientific ways of thinking, we are not implying that these are more or most important; rather, that there is agreement that at least these three overarching categories should be included. Related, we have also not come to any decision as to whether the undergraduate program should encompass only those three ways of thinking; we welcome white papers that conceive of undergraduate programs that include additional ways of thinking, such as engineering, design, or other technical fields.

Finally, we emphasize that the Task Force has not pre-determined the form of any requirement in this area; given the versatility of these ways of thinking, we can envision many possibilities of how they may be integrated into the curriculum.

This goal was informed by a variety of sources. The Silbey report provides extensive background on the goals and history of the "STEM GIRs", and learning goals provided by peer schools like Caltech and Harvey Mudd were also informative. Importantly, we heard the need for computation and statistics in many of the groups visited in listening tour sessions, as well as from the alumni survey and students currently at MIT. Breadth of knowledge and interdisciplinary thinking came up during the tour in multiple groups each, in different schools, as well as alumni noting the value of being scientifically literate and having a shared experience with their peers.

Goal 3

Every MIT graduate will be able to critically analyze their values, their responsibility to other people and the planet, and be able to articulate reasons for their choices. They will understand the relationship between individuals and society and how to evaluate events, texts, and artistic production from the past and present.

MIT graduates should not just know their values but have developed processes for formulating them. They should also be able to articulate to others their values and the underlying rationale, regardless of what those values are. This goal also gets at the notion of citizenship, be it in a

graduate's community, professional organization, nation, etc., and the idea that graduates will appreciate their relationship and responsibility to others in their society, as well as our planet. Developing these values necessarily requires knowing how to evaluate current and past events, texts, and artistic productions.

The importance of this goal was highlighted by multiple groups on our listening tour across different schools. In addition, the Alumni survey highlighted the importance of preparing our graduates to be "good citizens and leaders".

Goal 4

Every MIT graduate will be able to work collaboratively in teams, give and receive productive feedback, and take on leadership roles.

Working in teams is a critical skill. The MIT experience already includes many opportunities to work in teams, whether it is in 2.009, Rocket Team, the East Campus roller coaster, or the MIT soccer team. In all cases, it is important that MIT graduates know how to work in teams not just when everyone more or less agrees, but they must learn to effectively navigate conflict, which involves giving and receiving productive feedback. To the aspect of taking on leadership roles, we do not necessarily endorse a requirement that all MIT graduates become big-"L" leaders, but they should have the skills to step up to leadership roles when warranted, whether that is leading a meeting, coaching a child's soccer team, leading a team on a particular deliverable, or, if they wish, becoming a "C-suite" or political leader.

This goal was informed by discussions on TFUAP, as well as our listening tour session, and the alumni survey. One way that this manifested itself was in discussions of the importance of clubs and extracurricular activities that lead to student collaboration. Alumni noted that the skills they developed with the balance of hands-on work, theory, and realistic problems/projects are useful in their careers.

Goal 5

Every MIT graduate will be able to effectively use written, oral, and visual communication to articulate their opinions and ideas to a range of audiences. They will be able to actively listen to, and engage with others whose perspectives and opinions differ from their own.

The importance of communication skills of multiple types came up broadly in our listening tour. In addition, many alumni survey responses expressed the value of the communication skills they developed from the MIT Communication requirement, noting it as a critical aspect of their current work.

One sentiment that came up in Task Force discussions was the importance of visual communication, which is often left out in favor of written and oral communication. With technology making communication practices like graphic design, data visualization, diagramming, and even video more accessible to all, it is vital that our graduates are able to harness visual media to communicate. We also noted that "communication" instruction can often focus more on speaking/writing than listening, and we felt it was important to name that communication should be reciprocal. Likewise, many people in the listening tour mentioned that communicating to multiple types of audiences (e.g., expert/non-expert) was important to specify, as well as with those whose views differ from our own.

Goal 6

Every MIT graduate will be a critical reader, thinker, and listener who carefully examines assumptions, data, information, and ideas, before formulating an opinion or proposing a solution.

Critical thinking was mentioned in about half of all listening tour sessions, though definitions seemed to vary depending on the disciplinary context. Opinions about how well MIT currently teaches different types of critical thinking vary: alumni praised MIT's approach to teaching critical problem-solving rather than rote memorization of scientific concepts and equations, whereas some SHASS faculty voiced concerns that the existing program emphasizes technical skills over critical thinking and related skills like communication and social awareness.

Goal 7

Every MIT graduate will have the knowledge and skills to become a leading member and help advance the state of the art in their chosen field of study.

It is important that the undergraduate academic program enable departments to provide substantial education in their chosen field of study. Likewise, it is important that disciplinary academic programs be updated regularly in response to changing technology, industry trends, and scientific discoveries.

During our listening tour, we heard from some departments (in SoE) that majors feel restricted in what they offer to their students due to the presence of institute limits. Other groups were concerned that majors were too large already. While the Task Force does not yet have an opinion on this question, it is clear that every undergraduate program of study wants their graduates to be leaders in their chosen field of study. While we recognize that in many fields, students will need several additional years of education to become "leaders in their fields," we expect MIT undergraduates to be well on their way to achieving this level of excellence. Likewise, while few undergraduates will "advance the state of the art" independently, we expect that all of them will be equipped to contribute to such efforts by the time they graduate if they so choose.

Goal 8

Every MIT graduate will be able to apply their knowledge and skills to solve real-world challenges. They will be able to ask insightful questions and have the flexibility to creatively address problems from a variety of contexts, even those different from their chosen field of study.

Addressing important real-world challenges necessarily involves an appreciation of complex socio-technical systems and the ability to apply knowledge from one context/field to another context/field. Beyond *solving* problems, we want MIT graduates to be able to formulate insightful *questions*, as knowing the right question is a direct prelude to developing a good solution or realizing that most problems will not have a single "solution." While many of our graduates will focus on the immediate challenges facing the world, we also want to prepare our graduates to imagine a longer-term future and ask productive questions about how to realize goals that may take decades or centuries to achieve.

One concern voiced by faculty, staff, and alumni is that MIT students are generally good at solving well-defined problems, but can struggle when tasked with defining their own areas of inquiry and developing or sourcing the necessary expertise. Alumni and Career Advising and Professional Development staff specifically noted the tendency of MIT graduates to ignore business considerations and solely focus on the best technical solution to a given problem. In addition, it was noted that MIT students don't always recognize when and how to apply knowledge from one class to other contexts.

Goal 9

Every MIT graduate will be a curious, life-long learner, able to learn effectively in academic and non-academic contexts.

It is not possible over the course of a 4-year degree program to learn everything that one needs for the rest of their life, technical or otherwise. Additionally, many graduates' career paths are not straight and involve small or large deviations from their undergraduate course of study. Finally, the future is unknown, requiring MIT graduates to be nimble. It is essential, then, that MIT graduates know how to continue to learn after they leave MIT, with a curiosity to continue learning and using effective learning strategies with some scientific basis. This future learning will occur not just in future academic contexts (such as graduate school, online courses, etc.), but in non-academic contexts (on-the-job learning, independently seeking information about topics of interest, trying out new hobbies, etc.).

An effective and curious approach to learning also requires taking risks and learning from failure, and an MIT education should help graduates cultivate this mindset.

This goal comes from both practical arguments (e.g. today's students will likely have several different careers requiring different sets of skills) and more fundamental opinions about the goals of education (e.g. we should nurture a sense of curiosity and wonder in our students) that arose throughout the listening tour. Likewise, many community members recognized that given the fast pace of technological change in many fields, being able to learn new skills was essential to keep up in any industry, regardless of how frequently MIT updates its curriculum.

Process Goals

For all students, the MIT academic experience will:
1. Build & strengthen community, and support academic & social belonging
2. Support wellbeing
3. Include experiential learning
4. Celebrate unique passions, creativity, joy of learning, and sense of wonder

Goal 1

Build & strengthen community, and support academic & social belonging

The ability to form communities through shared academic challenges, unique residence hall cultures, and team-based extracurriculars was cited by alumni, faculty, and students alike as a key strength of the MIT experience. While aspects like residence life are outside of the Task Force's scope, we agreed that it was critical to structure the undergraduate academic experience to include opportunities to build community and promote feelings of belonging for all students.

Goal 2

Support wellbeing

Much of the rationale for Process Goal #2 echoes that for Learning Goal #1, but including wellbeing as a process goal means that we believe that pedagogy, policy, and culture at MIT should be formulated to support and encourage well-being while they are here.

Goal 3

Include experiential learning

Hands-on and experiential learning opportunities were cited by faculty, staff, students, and alumni from across MIT as vital parts of an MIT education. While some specifically named UROP as an essential experience, other forms of experiential learning, such as project-based coursework with external partners/mentors/clients, internships, social impact work, entrepreneurship, international experiences (MISTI, etc.), and substantial involvement in build teams (Rocket Team, Solar Car Team, etc.) were praised as impactful for similar reasons.

Goal 4

Celebrate unique passions, creativity, joy of learning, and sense of wonder

One of the strengths of MIT shared by many community members is our quirky students who enthusiastically pursue unique passions and interests. Yet at the same time, faculty and students alike lamented the emphasis on career skills and grades over learning for its own sake, and a few went so far as to say that the pressure of MIT was crushing the joy out of learning. Some particularly impactful comments came from current MIT seniors who noted that they only now have the time and freedom to explore topics purely out of curiosity and engage in extracurriculars simply for enjoyment. The members of the Task Force believe that passion, creativity, joy, and wonder should be characteristics of the entire MIT experience, not just the electives and clubs students finally make time for as seniors.