Task Force on the Undergraduate Academic Program

Draft Proposal February 2026

Contents

Executive summary

The MIT undergraduate educational experience has always included both intellectual breadth and disciplinary depth. Through the advancement of perennial and enduring goals, it equips students with the habits of mind and the tools needed to think deeply, act responsibly, and lead with insight as they tackle complex problems in a rapidly changing world. These enduring goals include:

- Developing students' technical skills and a breadth of ways of thinking;
- Fostering students' ability to critically read, think, reason and argue - enabling them to engage deeply with ideas across fields;
- Growing and strengthening students' ability to communicate effectively to broad and diverse audiences
- Ensuring that students not only master, but also creatively apply cutting-edge methods and tools in their disciplines.

In order to support and strengthen these goals, the Task Force on the Undergraduate Academic Program (TFUAP) was charged in Spring 2024 to undertake a systematic review of our undergraduate education, and to provide recommendations to ensure MIT's prominence/ preeminence in the future.

Over the past two years, TFUAP has:

- met with more than 80 groups across MIT, including academic departments, committees, councils, and relevant staff offices and groups
- read reports, articles, and surveys on the state of MIT undergraduate education and undergraduate education more broadly
- read and discussed more than 70 white papers submitted by the MIT community
- met 1-on-1 with dozens of relevant stakeholders to assess the impact of possible changes
- internally deliberated for well over a hundred hours

We have seen - first hand - the commitment and dedication to teaching and learning of our faculty and instructional staff, and the passion for high-standards and intellectual depth in the education of the unique and amazing students who entrust us with their education. Our discussions with members of the community and our review of and reflection on past reports, articles, and surveys have highlighted the many aspects and attributes that are critical to the success and essence of an MIT education. Those aspects need to be nurtured and further strengthened.

The world is quite different now than it was in 1965 - the last time MIT critically examined and substantially modified its core science curriculum. The goals we heard from the MIT community, reflecting the skills, knowledge, and qualities an MIT graduate should possess as well as the experience they ought to have on campus, are understandably different than those outlined a decade ago, let alone more than half a century. It was clear to us that MIT is not consistently meeting this new set of goals. Therefore, TFUAP envisioned the changes necessary for MIT to maintain its preeminence in the future of higher education.

We have laid out a set of recommendations that will improve and strengthen the undergraduate experience overall, and better prepare our students for fulfilling, productive and intellectually rich lives. We acknowledge that the recommendations will not be universally embraced, and that individual members of the community will take issue with isolated recommendations. We have sought to optimize a complex problem subject to the issues and constraints that surfaced in our two-plus years of listening, reading and discussing. We are confident that we have succeeded, however, we acknowledge that our recommendations involve trade-offs. We ask that readers keep the larger picture, and all MIT students, in mind as they consider this proposal.

The overarching principles that guide the function of our set of common, required classes (i.e., the GIRs) was defined by the RIC1 committee of Task Force 2021 and they are:

- Foundational Building Blocks – the GIRs provide a common body of knowledge that faculty can then assume in teaching advanced subjects. Courses fulfilling this function would serve as pre-requisites for later courses for many students.
- Literacy in Essential Fields – the GIRs provide substantive knowledge in areas with which every MIT graduate should be familiar.
- Methods for Creative Analytical Thinking – the GIRs provide portable tools and strategies for formulating, analyzing, and solving problems.

After developing a set of learning and process goals as shared in our Phase 1 report, it became clear that the current set of required classes (i.e., the GIRs) does not meet our goals, and that our graduates need new skills and knowledge to grapple with the challenges of a digital age. Thus, we propose to renew our curriculum to **advance** MIT's educational mission. We also realized that the way forward was not merely to adjust the set of required classes, but that the classes interact closely with policies that can aid (or hinder) the achievement of those goals. Individual policies–and curricular choices–although carefully created to achieve particular aims, end up obscuring our educational goals, so we propose to better **align** policies and curriculum with our aspirations and student needs. Finally, the intense and long-lasting effort required of committees such as ours (or the Silbey, Zacharias, Lewis, etc. committees) is in tension with the dynamic world in which we find ourselves, and which calls for the ability to **adapt** more quickly than in the past. Our revised curriculum and the associated governance structure are intended to respond to rapidly evolving technical, societal, and campus needs and opportunities.

Advancing our curriculum

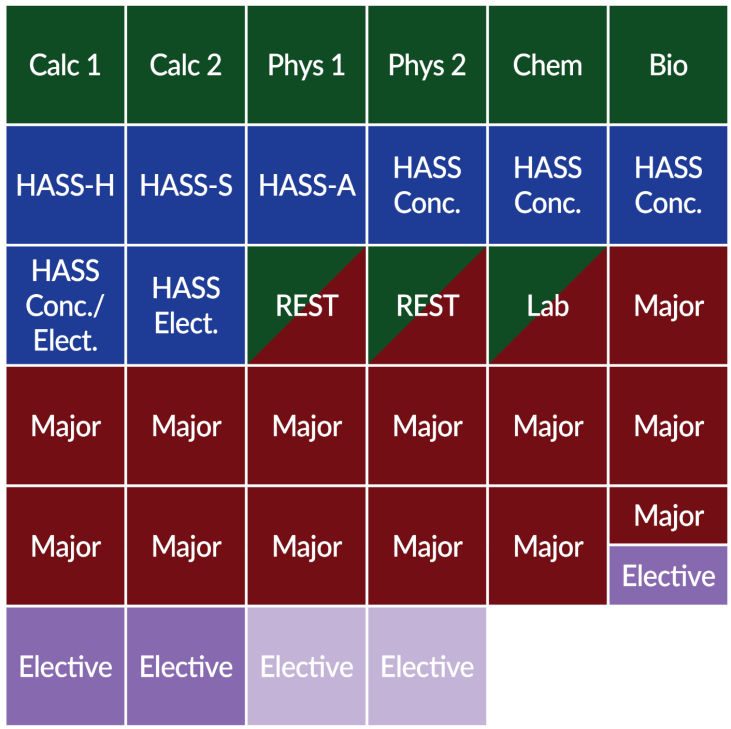
The current set of 17 subjects required of all MIT undergraduates is provided in the table below, and how they figure into a student's academic program is shown in the accompanying Figure 1.

General Institute Requirements (GIRs) *17 subjects*

<table>
<tr><td colspan="6">Science Core
6 subjects</td></tr>
<tr><td>Single-Variable Calculus</td><td>Multi-Variable Calculus</td><td>Mechanics</td><td>Electricity & Magnetism</td><td>Chemistry</td><td>Biology</td></tr>
<tr><td colspan="6">REST & Institute Lab
3 subjects</td></tr>
<tr><td colspan="4">Restricted Electives in Science and Technology (2 subjects)</td><td colspan="2">Institute Laboratory (1 subject)</td></tr>
<tr><td colspan="6">Humanities, Arts and Social Sciences (HASS)
8 subjects, including 2 communication-intensive (CI-H/HW in any category)</td></tr>
<tr><td colspan="6">Distribution Subjects
3 subjects, 1 from each category</td></tr>
<tr><td colspan="2">Humanities</td><td colspan="2">Arts</td><td colspan="2">Social Sciences</td></tr>
<tr><td colspan="6">Concentration Subjects
3-4 subjects as specified by the concentration department</td></tr>
<tr><td colspan="6">Elective Subjects
1-2 subjects, depending on concentration</td></tr>
<tr><td colspan="6">Communication-Intensive (CI-H/HW, CI-M)
4 subjects, two overlapping any HASS category, two in major</td></tr>
<tr><td colspan="6">Physical Education & Wellness Requirement
8 PE+W points plus swim requirement</td></tr>
<tr><td colspan="6">Major</td></tr>
<tr><td colspan="6">Up to 12.5 additional subjects, including 2 communication-intensive (CI-M)</td></tr>
</table>

Figure 1

Total Distribution of Subjects in Current Undergraduate Program, Assuming Maximum Major Size and Enrollment in 8-8.5 subjects/year for 4 years



**Maximum major size is 12.5 subjects, but majors may also specify up to 36 units of GIRs (typically REST and Lab, but sometimes HASS). Darker purple electives indicate 32 subjects total (includes required 180 units beyond GIRs), and lighter purple electives indicate 34 subjects total (maximum program size indicated in Faculty Rules and Regulations).*

There are many commendable aspects of this set of subjects. They provide MIT students with a rigorous and uniform core of science and math, along with rigorous training in the humanities, arts, and social sciences, both in breadth (via HASS distribution and SME GIRs) and depth (via HASS concentration and majors). The Institute Lab requirement provides some modicum of experiential learning for all students, with much more available via UROPs, extracurricular activities, and subjects in many majors.

However, there are several areas of concern with the current arrangement. First, there was a desire by the committee to incorporate new disciplines and areas of focus, most notably computation; linear algebra; probability, statistics, machine learning; teamwork; and ethical/moral reasoning into the required curriculum. This stood in tension with the fact that adding requirements is not feasible (Figure 1 above shows just 2.5-4.5 unrestricted electives given the standard load of 8-8.5 subjects per year), and the desire by the committee to give students choices wherever possible. Second, there is recognition that innovation often emerges at the intersections of fields, and that MIT can lead by educating students who move fluidly across boundaries and by integrating multiple disciplines, even within the common core. Third, given the foundational nature of GIR subjects and the desire to introduce students to the range of opportunities at MIT, there was concern that some students are taking these GIRs late in their MIT careers. Fourth, the REST and Institute Lab requirements, though well-intentioned, have evolved to primarily serve departmental goals rather than the original Institute goals. Fifth, while the organization of the HASS subjects (into the H, A, and S categories) is an arrangement that helps emphasize the underlying disciplines and ensures breadth in HASS fields, the categories are too broad to ensure that every student grapples with questions of values and ethics in a meaningful way. Finally, we believe that the communication requirement should broaden its focus from solely written and oral presentation.

We thus propose the following revised set of 15 subjects required of all MIT undergraduates (table below), and show a student's academic program under the proposed requirements in the accompanying Figure 2.

<table>
<tr><th colspan="12">General Institute Requirements (GIRs)
15 subjects</th></tr>
<tr><td colspan="12">Science, Math, and Computing Core
7 subjects (72 units) - To be taken in first 2 years</td></tr>
<tr><td colspan="12">Common Foundations - 3 Subjects, 36 units</td></tr>
<tr><td colspan="4">Single-Variable Calculus</td><td colspan="4">Multi-Variable Calculus
& Linear Algebra</td><td colspan="4">Physics</td></tr>
<tr><td colspan="12">Flexible Foundations/Essential literacy - 4 subjects, 1 from each category, across at least 36 units of credit - choice of two subjects taken as 12-unit versions and two subjects taken as 6-unit or integrated versions</td></tr>
<tr><td colspan="3">Chemistry</td><td colspan="3">Biology</td><td colspan="3">Computation</td><td colspan="3">Probability, Statistics, &
Machine Learning</td></tr>
<tr><td colspan="12">Humanities, Arts and Social Sciences (HASS)
8 subjects, including 2 communication-intensive (CI-H/HW) and 1 subject designated as "Moral and Civic Perspectives," which can overlap any category</td></tr>
<tr><td colspan="12">Distribution Subjects
3 subjects, 1 from each category</td></tr>
<tr><td colspan="4">Humanities</td><td colspan="4">Arts</td><td colspan="4">Social Sciences</td></tr>
<tr><td colspan="12">Concentration Subjects
3-4 subjects as specified by the concentration department, including at least 1 upper-level subject</td></tr>
<tr><td colspan="12">Elective Subjects
1-2 subjects, depending on concentration</td></tr>
</table>

Teamwork Intensive Requirement
1 subject, may overlap with major or GIRs

Communication-Intensive (CI-H/HW, CI-M)
4 subjects, two overlapping any HASS category, two in major

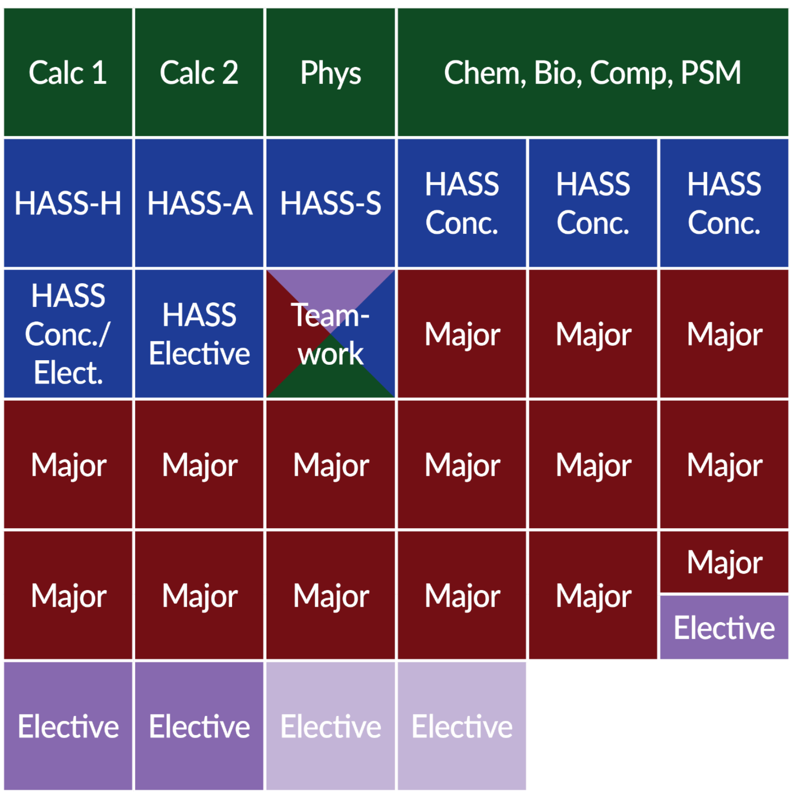
Physical Education & Wellness Requirement
10 PE+W points plus swim requirement

Major

Up to 14.5 additional subjects, including 2 communication-intensive (CI-M)

Figure 2

Total Distribution of Subjects in Proposed Undergraduate Program, Assuming Maximum Major Size and Enrollment in 8-8.5 subjects/year for 4 years



**Maximum major size is 14.5 subjects, but majors may also specify up to 12 units of GIRs (typically Teamwork-Intensive, but sometimes 12 units within Chem/Bio/Comp/PSM or HASS). Darker purple electives indicate 32 subjects total, and lighter purple electives indicate 34 subjects total (maximum program size indicated in Faculty Rules and Regulations).*

The table below shows a condensed view of the current and proposed programs side-by-side.

Current Program	Proposed Program
GIRs *17 Subjects*	**GIRs** *15 subjects*
Science Core *6 subjects (72 units)*	**SMC Core** *7 subjects (72 units)*
Calc I · Calc II · Phys I · Phys II · Chem · Bio	***Common Foundations*** *3 Subjects (36 units)*
REST & Institute Lab *3 subjects*	Calc I · Calc II + Lin. Alg. · Physics
REST I · REST II · Lab	***Flexible Foundations*** *4 subjects, 1 from each category; at least 36 units of credit* Chem · Bio · Comp · PSM
HASS *8 Subjects, including 2 CI*	**HASS** *8 subjects, including 2 CI and* ***1 Moral & Civic Perspectives***
Distribution Subjects *3 subjects, 1 from each category*	***Distribution Subjects*** *3 subjects, 1 from each category*
Humanities · Arts · Social Sciences	Humanities · Arts · Social Sciences
Concentration Subjects *3-4 subjects*	***Concentration Subjects*** *3-4 subjects, including at least 1 upper-level subject*
Elective Subjects *1-2 subjects*	***Elective Subjects*** *1-2 subjects*
Communication-Intensive (CI-H/HW, CI-M) *4 subjects, 2 in HASS, 2 in major*	**Teamwork Intensive Requirement** *1 subject, may overlap with major or GIRs* **Communication-Intensive (CI-H/HW, CI-M)** *4 subjects, 2 in HASS, 2 in major*
Physical Education & Wellness Requirement *8 PE+W points plus swim requirement*	**Physical Education & Wellness Requirement** *10 PE+W points plus swim requirement*
Major	**Major**
Up to 12.5 additional subjects, including 2 CI-M	Up to 14.5 additional subjects, including 2 CI-M

This new set of proposed required subjects incorporates subjects that already serve as foundations for most fields of study at MIT. Incorporating linear algebra into the second math subject enables follow-on classes to build on this subfield of mathematics, which is ever more prevalent. Our new set of subjects also include 1) computing, and 2) probability, statistics, and machine learning, which will enable students to navigate the data-rich world we live in, including creative application of technology for discovery and providing the possibility of learning the underlying mechanisms behind modern AI tools that many of our students will develop and wield. We are also excited by the ability to re-envision what a physics foundation should look like for scientists and engineers, and emphasize the importance of integrating disciplines. We emphasize that students should learn the core concepts from each foundational field in their first 2 years.

We propose that the REST and Institute Lab requirements be eliminated, with 24 units returned to the majors. Increasing the allowable size of majors to 11-14.5 classes (from the current 11-12.5) while allowing 12 units of overlap with the GIRs ensures that majors can adapt successfully to the new guidelines, and potentially free up space.

We propose a HASS requirement that will continue to require eight HASS subjects with the same distribution and concentration requirements. In addition, we propose adding a requirement that at least one of the eight required HASS subjects is certified as a Moral and Civic Perspectives subject. This new certification addresses the desire by many in the MIT community to provide students with frameworks for understanding how ideas about values, ethics, and responsibility emerge from and transform the contexts in which they are embedded, how to align their individual and collective values with their actions, and how to make decisions in society.

We find that the PE+W requirement works well, but propose it could be further strengthened by increasing it to 10 points (essentially adding one PE+W class), and students should be especially encouraged to undertake a Wellness class within those 10 points.

We propose incorporating a new type of constraint requirement focused on teamwork, an essential skill regardless of a student's future trajectory, and one often left for students to figure out. And to reward students who engage deeply with experiential learning and physical "making and breaking", we propose a new Mens et Manus scholars program.

Finally, though not explicitly noted above, we propose to broaden the communications requirement to incorporate visual communication and communications to non-experts (critical in today's environment), and to undertake experiments to understand how to best incorporate generative AI tools into these classes.

Aligning our curriculum & policies with our aspirations

Some of our overarching goals emerging from the task force are to better align our curriculum and policies with aspirations towards:

1. <u>Clarity</u>: Increase transparency and reduce complexity whenever possible.
2. <u>Commitment</u>: Refocus the classroom environment on high-quality in-person learning.

3. <u>Compassion</u>: Reduce unnecessary stress for students, instructors, and advisors.

The curriculum described above provides more freedom and choice to students, partially improving this alignment, but we realized that a wide range of policies currently interact to obstruct those goals. We thus propose the following set of policies:

1. Clarity
    a. Abolish the guidelines limiting overlaps between majors and GIRs
    b. Require that syllabi be posted publicly (or at least visible to all MIT users)
    c. Require interim grade reports one week before drop date
2. Commitment
    a. Eliminate pre-registration and move registration to the second half of the prior semester
    b. Shift Add Date and Drop Date earlier (to Week 4 and Week 9, respectively)
    c. Reduce scheduling conflicts and ban double-booking
    d. Reset classroom expectations, whereby:
        i. Students arrive on time and stay for the entire class
        ii. Instructors begin and end class on time
        iii. Students attend all classes
        iv. Laptops, tablets, and phones remain closed/off except when explicitly allowed by the instructor or DAS accommodation
        v. Instructors adopt pedagogical practices that ensure that attending class in person is valuable
3. Compassion
    a. Add a class day on the current fall Registration Day and remove a class day on the Wednesday before Thanksgiving
    b. Prohibit instructors from setting assignment due dates on holidays, the day before or after Thanksgiving break, or the day after spring break
    c. Shift the "last test date" earlier in the spring semester to better align with the fall

High-quality in-person learning, essential to our residential campus experience, relies on effective pedagogy. We thus propose a 5-year effort to broaden the adoption of improved pedagogy across campus, starting first with the new and revised GIRs and then working outward, led by our Teaching and Learning Laboratory (TLL) and the Open Learning Residential Education Team (OL-Res). This effort would help incorporate best pedagogical practices into our new and revised GIRs and then support those practices during the teaching of the subjects.

Adapting to the future

Task forces such as ours are intense exercises in part because they only occur every 20-30 years. We believe that MIT should be assessing its curriculum continuously. Additionally, we anticipate that the next 10-20 years will be especially dynamic, as AI transforms some aspects of education.

To enable us to adapt to the future, we propose a new governance structure for many of the MIT undergraduate requirements:

- An emboldened Committee on the Undergraduate Program (CUP) and Committee on Curricula (COC) tasked with engaging more fully with their existing mandates and supporting Institute-wide educational innovation;
- A set of new subcommittees of the CUP:
    - Ad Hoc Subcommittee on the Science, Math, and Computing Requirements (SSMCR), to potentially become a permanent subcommittee of CUP after 2-3 years
    - Ad Hoc Subcommittee on the Probability, Statistics, and Machine Learning requirement (SPSMR), to potentially become a permanent subcommittee or be absorbed into SSMCR
    - Ad Hoc Subcommittee on Teamwork Requirement (STR), to potentially become a permanent subcommittee of CUP after 2-3 years
    - These join the existing Subcommittee on the Communications Requirement (SOCR) and Subcommittee on the HASS Requirement (SHR)

We also propose the commissioning of two task forces:

- Task Force on Grading – grading emerged as a key element of the educational experience, with many community members advocating for reform
- Task Force on AI in Teaching and Learning – new AI tools are emerging all the time, and MIT needs a dedicated group to develop strategy and tactics around their incorporation

Our proposed requirements above are a substantial change, but there is an opportunity to further experiment with our undergraduate program. We thus recommend that the Institute also undertake an experiment in broad curricular flexibility, allowing a subset of the incoming class to choose to complete a subset of SMC, HASS, and major requirements to earn their degrees.

1: Background & Context

1A: History of the Humanities, Arts, and Social Sciences General Institute Requirements

The Silbey report provides an excellent history of the HASS core requirements over time. We direct interested readers to pages 64 through 68 of that report, summarize relevant aspects here, and add a brief account of the changes since the Silbey report was published.

From the outset, MIT's founders rejected a purely classical education and sought leaders fluent in modern science and civic life. Mid-century reforms led by the Lewis Committee accelerated this aim: MIT created a *School* of Humanities and Social Sciences, which was followed in 1951 by a highly structured, eight-subject HASS requirement anchored by a four-term paced Western civilization sequence and an upper-division "concentration." That tight core changed within a decade as MIT admitted more broadly prepared students—many with AP credit—and as newly strengthened, research-active social science faculties drew students toward advanced topics earlier.

A 1964 adjustment added limited flexibility, but there were still hundreds of students each year requesting exceptions to the core, prompting a 1974 overhaul that replaced the lower-division core with a distribution system spread across fifteen categories ("Hum-Ds"), retained concentrations, and added room for free HASS electives. The 1974 model proved too loose: advisors saw aimless course-picking, so in 1988–89 the faculty sharply tightened the system—reducing distribution categories from 23 to 5, and dramatically culling the number of approved subjects, imposing baseline writing and class-size expectations, and rebranding the list as HASS-D. Around the same time, HASS minors were introduced and widely adopted, and in 2000, the Communication Requirement addressed employer concerns about writing and speaking by requiring two communication-intensive HASS subjects (as part of an overall four-subject CI requirement), typically in the first two years. That overlap advanced important goals without expanding the GIRs, but it also made navigation harder and sometimes pitted the aims of distribution (breadth) against those of communication intensity (writing practice).

The Silbey report recommended restructuring the HASS into two major parts: a foundational phase and a concentration phase. The foundational phase would consist of four subjects – expository writing and three "foundational electives" distributed across the categories of the arts (A), the humanities (H), and the social sciences (SS). A three or four-subject concentration would be sponsored by a particular department or interdisciplinary field. A set of First-Year Experience subjects would be specifically created to cater to first-year students, and all students would be required to take one of these subjects as part of their foundational electives.

After the report's release, the Committee on the Undergraduate Program (CUP) charged a Subcommittee on the Educational Commons that worked for an additional year to refine the recommendations. They adjusted the distribution requirement to require one class across each of the H, A, and SS categories, leaving a free HASS elective subject as the eighth HASS requirement. The committee also proposed that the first-year subjects be optional. This proposal was adopted by the faculty in 2009, and the newly created Subcommittee on the HASS Requirement (SHR) was tasked with defining and evaluating the optional first-year subjects, which were eventually renamed HASS Exploration (HEX) subjects. These subjects are meant to be small, team-taught classes that explore a major concept or topic from multiple viewpoints across the humanities, arts, and social sciences. They can count towards the HASS Distribution (if applicable) or as a HASS Elective. SHR produced an interim report in 2011 and a final report in 2014, ultimately recommending that HEX subjects remain optional rather than required elements of the HASS curriculum. Since 2014, the number of HEX subjects has declined, with very few HEX subjects continuing to be offered each year.

1B: History of the Science General Institute Requirements

As with the HASS requirements, the Silbey report provides an excellent history of the Science core requirements over time, providing context for how we arrived at the current state of affairs. We direct interested readers to pages 39 through 44 and summarize the relevant aspects here, adding material to bring us to the current date.

Before 1962, MIT's Science Requirement was rigid: four semesters of physics, four of mathematics, and two of chemistry. However, as student backgrounds diversified and high-school curricula changed, the 1962 Zacharias Committee, led by Jerrold Zacharias, was convened to reassess the undergraduate curriculum. The committee's 1965 reforms reduced the prescribed science core by half—to two semesters of physics, two of math, and one of chemistry—and introduced laboratory (one) and science-area (three) electives. The Institute Laboratory Requirement emerged from this reform, emphasizing hands-on, problem-solving experience rather than rote lab exercises, encouraging students to think and work like professionals.

The science-area electives (which are now called the Restricted Electives in Science and Technology (REST) requirement) were intended to give students exposure to diverse scientific fields without enforcing uniformity. Originally, students chose one subject from each of six categories—life sciences, chemistry, mathematics, physics, earth sciences, and applied science, and a 6-unit engineering elective for non-ROTC students (this last elective was not pursued). This approach was simplified during implementation into the Science Distribution Requirement, in which students selected three subjects from different departments and fields. While this change added flexibility, it also created overlap between general education and departmental requirements; departments might require certain classes from those lists for their majors. Ultimately, departments were allowed to specify two of the four elective subjects in the Science Requirement. Thus, although subsequent curricular reform committees have debated the question of whether the GIRs could be tailored for different majors, MIT has, in fact, already allowed this for many decades.

Shortly after the implementation of the Zacharias reforms, the Chemistry requirement was broadened in 1969-70 AY from strictly 5.01 (Chemistry) to a set of options that included 3.091 (Chemistry of the Solid State), 5.41T (Introduction to Structure, Bonding, and Mechanism), or 5.60 (Chemical Equilibrium). Two years later, 7.01 was added as a fifth option in 1971-72 AY. Interestingly, 5.01 (eventually replaced with 5.40 General Chemistry) does not appear to have been a prerequisite for follow-on classes. Biology was allowed as an option until the 1985-86 AY, when the list of classes was tightened to allow only 3.091 or 5.11. In the late 1980s, an experimental subject combining chemistry and biology (SP.01) was an allowed option.

In the early 1990s, Biology (7.01x) was added back into the GIRs as a separate requirement by reducing the number of Science Distribution requirements to two subjects (which is also when they were formally renamed to the REST requirements).

In the intervening years, the REST and Institute Lab requirements were almost entirely co-opted by the majors. Of the 58 undergraduate majors analyzed by TFUAP, 36 majors count 24 units of REST in their degree programs, and 5 additional majors include 12 units; this accounts for all Engineering majors and all but one (Course 18) Science major. Additionally, all Engineering and Science majors (again, except for Course 18) use 12 units of Institute Lab in their degree programs.

In late 2003, a Task Force was again charged with reviewing MIT's undergraduate education. Chaired by Robert Silbey, the task force worked for 2½ years "to address the goals, content, and structure of MIT's undergraduate education." The Silbey Task Force concluded that while the existing core prepared students well for traditional disciplines, it fell short of the breadth and creative capacity needed to bridge fields and lead emerging, hybrid areas of science and engineering. The Task Force instead proposed an eight-subject Science, Mathematics, and Engineering (SME) Requirement, with a set of three Required Subjects (Mechanics, Single-Variable Calculus, Multi-Variable Calculus) and then a flexible choice of five of six Foundational Subjects across Chemical Sciences, Computation & Engineering, Life Sciences, Mathematics, Physical Sciences, and Project-based Experience.

The Task Force's report and recommendations were released in October 2006 and were then reviewed in a variety of forums in the 2006-7 AY. In October 2007, the Committee on the Undergraduate Program (CUP) charged a Subcommittee on the Educational Commons that worked for an additional year to refine the recommendations. Their report, released in November 2008, reformulated the Silbey recommendations for the Science core to an eight-subject SME requirement encompassing one semester each of Single-Variable Calculus, Multi-variable Calculus, Classical Mechanics, Electricity and Magnetism, Chemistry, Biology, and two new types of classes: SME Foundations and Elements of Design. Each of the 6 specified required subjects would be offered in various flavors (akin to the 7.01x subjects). SME Foundations would "provide introductions to fundamental topics and/or modes of analysis that are broadly applicable in science, mathematics, and engineering," such as "differential equations, probability, statistics, discrete math, linear algebra, and computation." These would be allowed to be specified by the departmental programs. Elements of Design would "capture modes of reasoning that facilitate design" and "that build the core modes of reasoning in the context of authentic problems from fields across the Institute." There would be multiple flavors of this requirement.

The proposed revision to the Science core ultimately failed in a faculty vote in 2009 for a variety of reasons. Some faculty thought the reforms were not radical enough, while others were concerned about the "flavors" of the Science Core.

In 2016, Chair of the Faculty Krishna Rajagopal and Dean for Undergraduate Education Denny Freeman charged a working group, chaired by Professor Eric Grimson, to examine the role of "algorithmic reasoning/computational thinking" in MIT's undergraduate education. The working group ultimately proposed that "computational thinking should play an explicit role in the formal education of all undergraduate students at MIT." CUP then took up the report and proposed two approaches for incorporating a computational requirement into the GIRs: reducing the REST requirement by one subject in order to add a 12-unit computing GIR, or keeping the REST as-is and adding a 6+6 unit computing GIR to the set of Science GIR requirements, where 6 units would be introductory from a list of approved subjects, and the 6 units would follow-on as mandated by departmental programs. Ultimately, however, this Computational Thinking GIR did not appear to have enough support among the faculty to proceed.

In 2019, then Chair of the Faculty Professor Rick Danheiser convened an Ad Hoc Working Group on the SME Requirements. This effort was then followed by the Undergraduate Program Refinement and Implementation Committee (also chaired by Rick Danheiser) as part of the COVID-era Task Force 2021 and Beyond. That committee outlined the process that led to TFUAP's creation, noting that this effort had already been postponed due to the focused response to the COVID-19 pandemic.

1C: MIT's Legacy of Educational Innovation

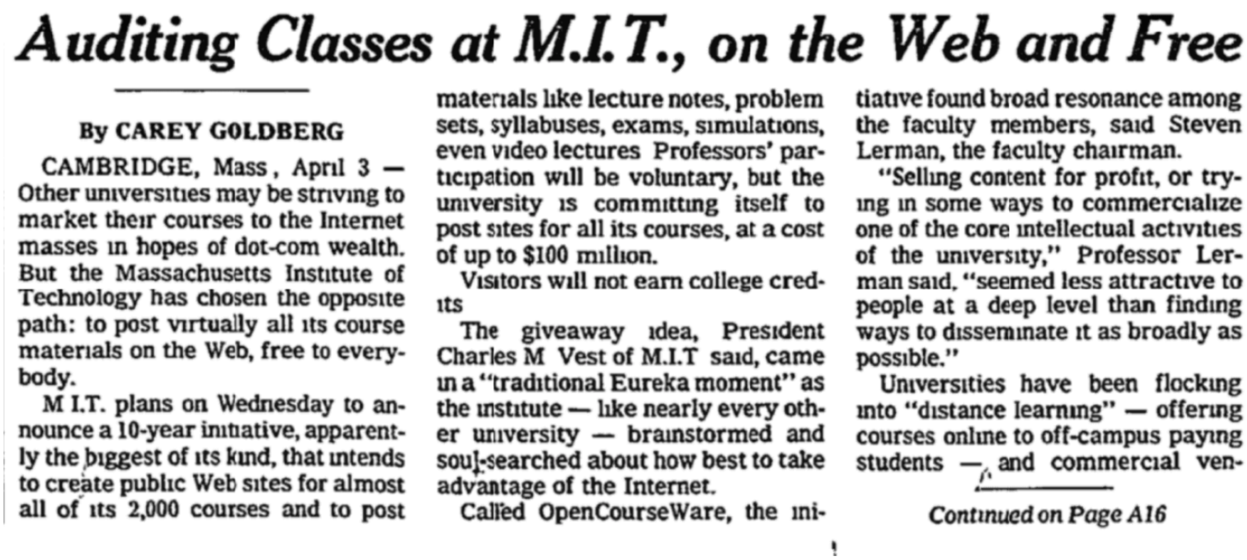
From its founding more than 150 years ago, MIT has spearheaded numerous educational efforts that have been copied around the globe, constantly focusing on new ways to bring the spirit of "mens et manus" to life both on campus and beyond.

Three of the most beloved educational innovations that have come to define an MIT education over the past fifty years are UROP, IAP, and first-year learning communities, established in 1969, 1971, and 1969, respectively. While undergraduate students had worked on faculty research before then, the creation of UROP represented one of the first formal programs recognizing this practice. The formula for a UROP has not changed: projects must have educational value for the student and the approval of an MIT faculty member or other approved researcher, but the program has exploded in size, with 93% of undergraduates now participating at least once. Undergraduate research has similarly been formalized at countless research universities, with many citing MIT's program as a model and several adopting the same name.[1] IAP, meanwhile, was established with several goals in mind, including both practical concerns associated with the prior practice of ending the fall term in January and pedagogical aspirations of creating a time for more flexible, leisurely, and independent approaches to learning, teaching, and research.[2] The first first-year learning community, the Experimental Study Group (ESG) was established in Fall 1969 to encourage active student involvement, independent work, and communication. ESG offers classes that cover the SME GIRs as well as several HASS options. A year later, Concourse established a cooperative curriculum between science, humanities, and engineering. Terrascope was founded in 2002 to "foster and facilitate multidisciplinary research and education efforts in earth and environmental sciences." Most recently, Design Plus was created in 2021 to provide a first-year community focused on design and making. In an alternative to the conventional large

[1] MIT Undergraduate Research Opportunities Program Strategic Plan Summer 2025
[2] The Independent Activities Period (IAP) Subcommittee of the Faculty Policy Committee

classroom experience, these first-year learning communities are valuable cohort-building experiences that facilitate collaborative learning and higher levels of student-instructor interactions.

More recent examples of MIT's educational innovation have focused on using technology to democratize and amplify learning. In 2001, MIT announced OpenCourseWare (OCW), which would allow anyone with an internet connection to access MIT's syllabi, lecture notes, exams, and video lectures at no cost. Since its launch, OCW has reached hundreds of millions of learners from all parts of the world, including many who go on to pursue a degree at MIT. This bold move by MIT helped catalyze the Open Educational Resource (OER) movement, which aims to democratize access to high-quality educational materials.[3]



Auditing Classes at M.I.T., on the Web and Free

By CAREY GOLDBERG

CAMBRIDGE, Mass., April 3 — Other universities may be striving to market their courses to the Internet masses in hopes of dot-com wealth. But the Massachusetts Institute of Technology has chosen the opposite path: to post virtually all its course materials on the Web, free to everybody.

M.I.T. plans on Wednesday to announce a 10-year initiative, apparently the biggest of its kind, that intends to create public Web sites for almost all of its 2,000 courses and to post materials like lecture notes, problem sets, syllabuses, exams, simulations, even video lectures. Professors' participation will be voluntary, but the university is committing itself to post sites for all its courses, at a cost of up to $100 million.

Visitors will not earn college credits.

The giveaway idea, President Charles M. Vest of M.I.T. said, came in a "traditional Eureka moment" as the institute — like nearly every other university — brainstormed and soul-searched about how best to take advantage of the Internet.

Called OpenCourseWare, the initiative found broad resonance among the faculty members, said Steven Lerman, the faculty chairman.

"Selling content for profit, or trying in some ways to commercialize one of the core intellectual activities of the university," Professor Lerman said, "seemed less attractive to people at a deep level than finding ways to disseminate it as broadly as possible."

Universities have been flocking into "distance learning" — offering courses online to off-campus paying students — and commercial ven-

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Excerpt from [New York Times article published April 4, 2001, by Carey Goldberg]

For on-campus learners, one of the most impactful changes in recent decades was the adoption of Technology Enabled Active Learning (TEAL) in the physics GIRs. The shift from the traditional model of lectures and recitations was spearheaded by Professor John Belcher in 2000, responding to the nationwide pedagogical trends in the late 1990s and a desire to improve attendance and reduce failure rates in introductory physics. The TEAL model, now standard across the physics GIRs, relies on in-class problem-solving, small group work, and a large teaching team that can provide immediate feedback on students' work. After succeeding in bringing down failure rates, MIT's Department of Physics has continued to iterate on the TEAL model, responding to student feedback, changing technology, and increasing understanding of how students learn best. The model has been adopted in other schools as well. Yale cites MIT's model as the inspiration for their TEAL classrooms.[4]

[3] About Us | MIT OpenCourseWare | Free Online Course Materials
[4] TEAL at Yale | Poorvu Center for Teaching and Learning

1D: Why now?

The world is changing and the pace of change is increasing. We need an education that is much more responsive and flexible. If we cannot keep up, public trust in MIT's education will decline accordingly. Likewise, we owe it to our students to engage them in deep learning that takes advantage of the best of a residential college experience and current best practices in education. Given MIT's legacy of educational innovation and leadership, we are well-equipped to pursue opportunities to improve students' ability to achieve the learning and process goals that we heard from the community at the beginning of our process. This involves not just the GIRs, but other avenues by which our students learn, and their classroom experiences over the course of their MIT career.

Students are also being bombarded with demands and have more distractions than past generations (e.g., smartphones). Our future students need MIT to think carefully about the residential educational experiences and structures that optimize students' learning, stripping away the distractions to focus on cultivating the sense of wonder and curiosity that fuels student learning, exploration, and engagement.

Some of the most interesting questions and grand global challenges involve intersections between disciplines. And yet the majority of classes, including GIRs, involve teaching that is mono-disciplinary. The students who will arrive on campus in the next few years deserve a cross-cutting education that highlights the best of MIT, the interdisciplinary creativity and collaborativeness of our scientists, engineers, humanists, artists, designers, and innovators, who work tirelessly to advance human knowledge and create a better world.

The last substantial change to the structure of the Science GIRs occurred in 1965, 60 years ago. Since then, besides the relatively straightforward exchange of Biology for a REST class, no other programmatic changes have occurred, despite multiple efforts to update the requirements. However, our world now differs dramatically from 1965. As one trivial example, in the 1960s, there were few computers on campus; IBM mainframes arriving on campus were front-page news in The Tech. Now, each of us routinely carries around multiple computers, each of which is more powerful than a 1980s-era Cray supercomputer.

To its credit, the MIT community has adapted within this fixed framework: instructors have modernized pedagogy (from TEAL in physics to "goodie bags" in 3.091), course content has tracked breakthroughs (CRISPR in biology, incorporation of some linear algebra topics into 18.02), and students increasingly treat computation as essential preparation for many majors and as a vital skill for 21st century scientists, engineers, humanists, designers, and artists.

As we enter the second quarter of the 21st century, we need a program that can more nimbly adapt to the accelerating pace of change across nearly all aspects of education, research, and society. *MIT's continued leadership as the premier institution of science and technology requires us to lead in this moment.*

As TFUAP engaged the community, formulated a set of learning and process goals, collected white papers, met 1-on-1 with relevant stakeholders, and worked to design a new undergraduate academic program, new crises and opportunities emerged that have made the future increasingly murky. To name just two, the rise of generative AI and the implications of recent federal policies on MIT's budget have demanded enormous amounts of faculty energy and an ever-evolving response. While some have questioned the prudence of engaging in a large-scale curriculum revision process in these conditions, TFUAP notes that the changes to curriculum and curricular flexibility, robust governance, and the interdisciplinary focus of our proposal will serve us well in the uncertain times ahead. Inaction now would result in MIT missing a critical opportunity to address the growing convergence between disciplines, including, but not limited to, computing and generative AI.

1E: What might an MIT education look like in ten years?

No group of faculty members can predict the future, but having studied the past and present and thought deeply about what we want for future MIT graduates, TFUAP has developed a vision for the MIT of 2036.

When envisioning the learning experiences to inspire and challenge our students and best prepare them for purposeful and fulfilling lives and careers, we prioritized:

1. A wide breadth of disciplines in which students can develop essential literacies - adding computing; probability, statistics, machine learning; moral and civic perspectives; and teamwork to its rich core.
2. Exposure to and engagement with a broad range of disciplines and disciplinary thinking within their first 2 years.
3. Academic and intellectual growth and inspiration in an educational environment that promotes their well-being by providing space and time for deep learning and reflection.
4. Deep and meaningful student engagement with peers and instructors in learning environments across the institute, leveraging the unique and transformative affordances of in-person, residential education.
5. Experiences that allow students to see connections among fields, and to engage with and innovate in these fertile multidisciplinary spaces.

In our imagined future, students will develop disciplinary knowledge, critical reading and thinking skills, the ability to communicate and collaborate within and across disciplines, facility with the latest technical tools for accessing and processing information, and the ability and motivation to critically evaluate the costs and benefits of those tools. Building on core knowledge in science, math, computing, humanities, arts, and social sciences, students will explore the frontiers of thought with a sense of wonder, working closely with faculty on a variety of scholarly pursuits in labs, centers, libraries, research sites, museums, performance spaces, and in the community, at MIT and beyond.

Their data literacy and familiarity with not only the use of vanguard technologies, but also the workings and impacts of these technologies, will enable them to question the many claims they encounter and carefully untangle facts from fiction. Their rigorous study of the humanities, arts, and social sciences will build their understanding of themselves and society, encouraging and enabling them to solve problems more ethically and effectively.

Knowing that every MIT student has studied computation, science, probability, statistics, and machine learning will enable classes across the institute to leverage the latest tools and rigorous technical methods for solving problems. By delegating basic calculations and other mechanical tasks to machines, instructors and students alike will spend more time on creative, complex, and interpersonal pursuits. As MIT doubles down on our collaborative learning environment through a new Moral and Civic Perspectives requirement and new teamwork-intensive classes, students will learn to work more effectively and across differences with their peers.

We envision that faculty will embrace this new spirit of collaboration: serving together on task forces and subcommittees that oversee innovation and improvements across the GIRs; guiding MIT's evolving response to AI; and crafting new grading practices and policies that effectively and accurately evaluate student learning.

As described in Section 4, instructors involved in GIRs will benefit from a variety of formal and informal opportunities to collaborate with their colleagues to share research-based best practices and to leverage technical and interpersonal connections across disciplines. These interactions will enrich instructors' teaching experiences while supporting deep and enduring student learning and understanding.

Even in this dynamic environment, other experiments with pedagogy, curriculum, and policy will be ongoing.

Guided by our shared values and learning goals, we will adopt an MIT approach, relying on ongoing discussions of undergraduate programs and learning experiences: leveraging innovative ideas; collaboration across disciplines and roles; and data-informed decision-making. As highlighted in the Executive Summary and described throughout our report, we propose structures and processes to ensure that the MIT undergraduate experience can more nimbly adapt to future opportunities and challenges while remaining true to our mission and values.

For a full distillation of our community listening, including a complete description of what TFUAP believes every MIT graduate should know or be able to do, see TFUAP's Phase 1 report.

2: Curriculum

In designing a new set of General Institute Requirements for undergraduates, TFUAP relied first and foremost on our set of learning and process goals developed in Phase 1. These are fully described in our Phase 1 report and listed in Appendix B, so we will not repeat them here. In short, these goals sum up the things we think every MIT graduate should be, know, and be able to do, plus a few qualities that should characterize their education while they are here. Some of these goals are unique to MIT, while many could be viewed as equally appropriate at any of our peer schools. The combination of all of them, marrying STEM and HASS and mind and hand, represents both the best of what MIT education is and has been, and what we and many in the community believe it could become.

Underlying the whole set of goals is a core tension between competing aims: 1) teaching a growing list of foundational areas needed by MIT graduates; and 2) providing time, space, and structure to enable the sense of 'play' and creativity that fuels our amazing students and reduces feelings of overwhelm. It is impossible to achieve both aims without rethinking the structure and content of existing requirements, but TFUAP also felt strongly that each discipline within the current GIRs is an essential field that students should encounter before graduating, and in some cases in the first 2 years of their MIT career. The proposal below represents our best attempt to reconcile these aims.

2A: Science, Math, and Computing GIRs (SMC)

The three goals of the GIRs described at the start of our report were reinforced by a Foundational Working Group on the SME GIRs, which studied the existing science core subjects and provided a report to TFUAP to inform our work. TFUAP agrees that these three goals describe well the functions of both the current science core and the proposed SMC GIRs and that the departments stewarding these subjects are delivering high-quality learning experiences to our students.

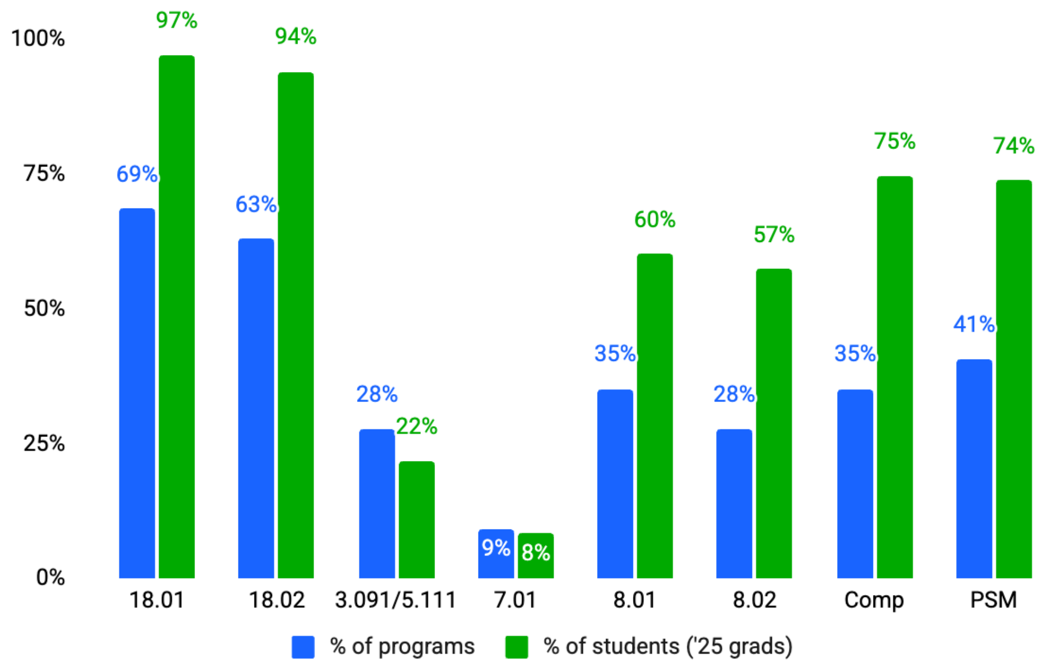
Beyond these three goals, we add two additional ones, informed by our listening tour and internal deliberations over the past year-and-a-half:

4. Cohort-building experience – the GIRs serve an important function as a cohort experience, welcoming students to MIT's academic community and allowing them to get to know their peers.
5. Leadership – our GIRs communicate to our students, employers, peer institutions, and K-12 schools what MIT considers critical to a science and engineering education.

Importantly, however, most of the GIR subjects serve some, but not all, of these functions, and some functions vary depending on the student's eventual major (Figure 3).

Figure 3

SMC Subjects Required by Primary Major



**Subjects were classified as "required" if listed as a prerequisite for at least one required subject (for current GIRs) or if at least 6 units of applicable content[5] were included in major requirements (for proposed Computation and Probability, Statistics, and Machine Learning GIRs). Student counts are based on primary majors of the graduating class of 2025. Actual numbers of students who require each subject are likely higher due to second majors, minors, and pre-health requirements.*

In addition to the existing science core areas of calculus of single and multiple variables, physics (specifically mechanics and electricity and magnetism), chemistry, and biology, our listening tour highlighted other areas of study that have emerged as critical to achieving these goals. These include computation, linear algebra, probability, statistics, and machine learning.

Noting that it is impossible to reasonably devote an entire class to each of the existing and new topics and still allow students to graduate in four years, it becomes necessary to address multiple topics within each 12-unit subject. This will require restructuring of some classes, but it maintains exposure to the core topics and ways of thinking within science, math, and computing that have long been deemed essential fields, while making space for the new foundational topics.

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[5] Subjects with 6+ units of applicable computing content: 6.1000/6.100A, 1.00(0), 2.086
Subjects with 6+ units of applicable PSM content: 1.010A, 1.010B, 1.073, 1.074, 2.086 + 2.671, 6.100B, 6.C01, 6.3700, 6.3800, 6.3900, 9.07, 14.30, 15.069, 16.09, 16.C20J, 18.05, 18.600, CSE.C20J
Note that this was for preliminary analysis and does not mean that these subjects will count for the associated proposed GIR.

Why not "choose X from a list of Y"?

When faced with the problem of more topics to cover than subjects in which to cover them, it is natural to consider leaving the choice to students by giving them a list of Y classes (where Y > 6) and asking them to choose X (where X = 6 or whatever you deem the maximum number of subjects to require). TFUAP considered this possibility but ruled it out because it goes against the stated goals of the GIRs. If we consider these fields "foundational" and "essential," how can we allow students to graduate without encountering them? We also worried that such a system could create a "race to the bottom" where students selected classes based on a rational but unhealthy impulse to take classes with the lowest reported workload and highest average grades.

Fundamentals for All, Building Blocks for Some

Every topic we listed represents some combination of goals of the GIRs, namely: "foundational building blocks," "literacy in essential fields," and "methods for creative analytical thinking" that we deemed necessary for every MIT graduate, but some of the topics are foundational building blocks for some, but not all students. For example, the biology and chemistry GIRs are, for many MIT students, the only biology and chemistry-related subjects they take in college. These subjects teach these students literacy and methods for creative analytical thinking, but for this subset of students, they do not serve as foundational building blocks for more advanced coursework. Likewise, some students in the sciences and humanities might not need the same foundational building blocks in computing and/or PSM as their colleagues in engineering, but such subjects serve to teach these students literacy and different methods for creative analytical thinking. In our current system, all students would take the same classes regardless of future major and end up using the vast majority of their precious time at MIT fulfilling requirements rather than having the flexibility to explore possible directions of study.

In our proposed SMC GIR plan, outlined below (Table 1), students could opt to take one "integrated GIR" which would cover the aspects of two interconnected fields that the faculty feel every MIT graduate should know, or, alternatively, two 6-unit single-discipline 'exposure' subjects. In total, this would result in students taking at least 72-units of SMC GIR subjects. The specifics of these subjects can be found below. We hope that "integrated GIRs" might incorporate other disciplines in the future, including eventually combining HASS and SMC, and encourage MIT to support, both financially and administratively, pilots of such classes.

Table 1

Topics covered in the proposed SMC core

Required Areas of Study	Approaches to satisfy (total = 72-84 units)
Calculus (Single variable + Multi-variable)	Sequence of 18.01 (single variable calculus, 12 units) and 18.02 (combined multi-variable + linear algebra, 12 units)
Linear Algebra	

Physics	New Physics I GIR (12 units) or Physics II GIR (12 units) for students with AP/ASE Physics I credit
Chemistry (6-unit, 12-unit options, + 12-unit integrated option)	Choose at least 36 Units worth of Chemistry, Biology, Computation, and PSM. All 4 subject categories are required.
Biology (6-unit, 12-unit options, + 12-unit integrated option)	
Probability, Statistics, and Machine Learning (6-unit, 12-unit options, + 12-unit integrated option)	
Computing (6.100A (6 units), 6.1000 (12 units), integrated option (12 units))	

Pacing Requirement

Given the foundational nature of all the SMC GIRs, their role as cohort-building experiences for MIT students, their important function exposing students to disciplinary breadth early on as they contemplate potential career paths, and their pedagogical approach that teaches learning habits students build on in subsequent coursework, TFUAP feels that it is important for students to take these subjects early in their time at MIT. While we expect that students will complete most SMC subjects in their first year, we hope to preserve some flexibility for students to explore majors, retake subjects as needed, and pursue electives in their first year. Therefore, we propose that students be required to complete 72-units of SMC GIRs by the end of their sophomore year.

Calculus I

TFUAP believes that given the fundamental nature of single-variable calculus (see Figure 3) and the close mapping of 18.01 topics to those currently taught in AP Calculus BC (which most incoming students use to satisfy this GIR), the 18.01 requirement should remain unchanged. Continued attention should be paid to ensuring that 18.01 and 18.01A are taught effectively so that all MIT students can build a solid foundation in calculus early in their time at MIT, regardless of the opportunities available to them in high school.

Calculus II & Linear Algebra

Rationale

Historically, 18.02 has been almost exclusively a subject on calculus that focused on the big integral theorems that closely tie to 8.02, with an emphasis on two and three dimensions (the "physical" ones). In recent years, 18.02 has slowly evolved, introducing more linear algebra and de-emphasizing integration. This shift reflects the increasing role of linear algebra across the curriculum, as well as advances in computing that make it easy to compute integrals that once would have been daunting. The shift was also meant to avoid duplication of basic linear algebra that currently happens in 18.03 and 18.06. Finally, it also reflects the increasing importance of numerical modeling compared to classical continuous modeling using differential equations. These trends have only continued, and there is a strong argument to keep 18.02 as a GIR and further evolve it.

Requirement

TFUAP proposes that MIT continue to require a second math class, nominally 18.02, for all students, but that the content of 18.02 be revised to include linear algebra.

The current version of 18.02 has 3 distinct units:

1. Vectors, matrices, and basic linear algebra (new within the last few years)
    a. vectors: addition, scalar multiplication, and dot products
    b. matrices, determinants, and cross products
    c. lines, planes, and systems of linear equations
    d. eigenvalues and eigenvectors
2. Differential multivariable calculus
    a. parameterized curves, velocity and acceleration, polar coords
    b. functions of several variables, graphs, and level sets
    c. partial derivatives and gradients, tangent planes, and linear approximation
    d. optimization, first and second derivative tests, saddle points, least squares
    e. chain rule
    f. Lagrange multipliers and eigenvalues revisited
3. Integral calculus in several variables
    a. double and triple integrals
    b. change of variables and Jacobians
    c. polar, cylindrical, and spherical coordinates
    d. line integrals and Green's theorem
    e. surface integrals and flux
    f. divergence theorem
    g. Stokes' theorem
    h. conservative vector fields and potentials

At present, linear algebra comprises roughly two weeks of class time, and the other two units make up most of the class. The content in units 1 and 2 is widely applicable, both in the physical sciences and in computing and elsewhere. However, much of the content in unit 3 is more narrowly applicable to physics and some engineering disciplines, making it more appropriate in an introductory class serving those majors rather than all MIT students.

Some important topics that TFUAP believes should be expanded include:

- Work in large dimensions.
- Linear algebra, including subspaces, basis, and dimension, as well as more content on matrices, including rank, column space, and null space.
- Gradient descent and optimization.
- Convexity.

This expansion could be achieved by further reducing the integral calculus.

Process, Timing, and Oversight

We anticipate that it will take one academic year to revise and pilot this new version of the class. This revised calculus & linear algebra class, along with the single-variable calculus class, will be overseen by the new subcommittee on the SMC requirement described below.

Physics

Rationale

8.01 (Physics I, covering classical mechanics) and 8.02 (Physics II, covering electromagnetism) have served the MIT undergraduate student population since MIT's inception. (Before 1962, four physics subjects were required, but the requirement was reduced to two after the Zacharias report.) These subjects have been leaders in new pedagogy (i.e., TEAL) and a worldwide model for teaching general introductory physics. Within MIT, in addition to providing an introduction to some fundamental physics concepts, these subjects serve as a cohort-building experience, prepare students for a variety of degree programs, reinforce mathematical concepts taught in 18.01 (Single-variable calculus) and 18.02 (Multi-variable calculus), and transition incoming students to the rigor of the MIT undergraduate experience.

These classes originally explicitly served "to provide a substantial foundation for subsequent engineering studies" (Lewis et al., p. 37), though in the past half-century their purpose was appropriately broadened to show "how mathematics and the natural sciences are intellectually intertwined and how reductive science can best be approached" (Silbey et al., p. 47) in the case of 8.01, to build students' problem solving and critical thinking skills that are important across many areas of engineering and the sciences.

The idea of reducing the number of required physics subjects to one was perhaps first broached by the Silbey commission, which recommended requiring 8.01 and providing 8.02 as an option for students to take. Almost twenty years later, we are motivated by a similar–even more urgent–desire to incorporate new topics and ideas into the required core curriculum as we look to update and modernize MIT's undergraduate curriculum. However, rather than simply choosing 8.01, we believe there is a long-term opportunity to devise a new introductory physics GIR subject.

Requirement

We propose a Physics GIR subject that evolves over three phases. In the initial phase, the Physics GIR subject will be 8.01 Mechanics. We chose this subject instead of 8.02 for a few reasons. First, mechanics is a subject for which students have natural intuition. Second, most students enter MIT having had mechanics taught in an algebraic context, easing the extension to college-level mechanics taught with calculus. Here, their natural intuition helps them when tackling new concepts and solving problems, as nonsensical answers are easier to identify. Third, 8.01 is widely applicable to a variety of majors: 19 degree programs, representing almost 700 students, require 8.01 for a follow-on course in their major.

In Phase 2, we propose that the Physics department, in consultation with downstream departments, develop a set of Physics II subjects that would build on 8.01 and bring the wide breadth of Physics to early undergraduate students. These subjects would include 8.02 Electricity and Magnetism (E&M), but subjects could also include aspects of Statistical Mechanics, Modern Physics, and other foundational topics.

Finally, in Phase 3, the Physics department would revise the main Physics GIR (8.01). There may be opportunities to incorporate topics, like E&M or modern physics, into the Physics I GIR. For example, mechanics and electromagnetism are two domains that process energy, coming together in electromechanical systems such as motors and generators. There are also opportunities to incorporate computation into the Physics GIR, much as Math is currently reinforced in 8.01. The subject can leverage the experience in ES.801 and ES.802, which introduced computational thinking assignments into the ESG versions of 8.01 and 8.02 (associated white paper).

Importantly, students who place out of Physics I using ASE or AP Credit, in any of these phases, would be required to take a Physics II subject to satisfy their Physics GIR. In this way, all MIT students would be exposed to Physics at the MIT level, taught by MIT faculty.

Process, Timing, and Oversight

We propose that at the outset (Phase 1), the Physics GIR be 8.01 and its variants, or 8.02 and its variants (for students who test out of Physics I), as those subjects currently exist. In Phases 2 and 3, the Physics department should seek broad input from the science and engineering community about content and pedagogy, but should ultimately aim to develop a set of coherent and rigorous subjects for the Physics II subjects and the revised Physics I subject.

Impact on 8.01 and 8.02

We anticipate minimal impact on 8.01 in Phase 1, though in the long term, the subject should evolve as noted above. 8.02 will decrease in size, though it is currently required by 15 departmental programs encompassing >650 students and will serve as the GIR for students testing out of Physics I, and so the enrollment will still be substantial.

Impact on existing courses

A single Physics GIR subject will undoubtedly impact majors that rely on 8.02. Majors that depend on 8.02 will need to add that to their major requirements, or teach the required concepts in other subjects.

AP credit and ASE

We do not anticipate any changes to AP credit and ASE for the Physics GIR, but note, as mentioned above, that students receiving AP or ASE credit for Physics I would be required to take a Physics II subject to satisfy their GIR.

Flexible Foundations/Essential Literacy GIR Subjects

Rationale

MIT has an opportunity to lead by incorporating interdisciplinary courses into the fabric of its curricular DNA (the GIRs). Many real-world challenges require collaboration between fields. While MIT is expert at providing such instruction near the end of a student's undergraduate career (such as in capstone classes), and we have a history of experiments at the beginning of their career (e.g., the First-Year Learning Communities), we believe MIT should bring integrated curricular offerings to a broader audience of students at the outset of their undergraduate career.

We propose the development of a set of integrated subjects that would serve as GIRs. Integrated subjects would be intended to: 1) prepare students for a future defined by collaboration, creativity, and societal impact; 2) Ensure all students, regardless of major, develop a holistic scientific and data literacy; 3) Meet the needs of majors and nonmajors in these fields alike; and 4) Establish curricular flexibility that enables new GIR course development and faculty collaboration. We note that the REST subjects, formerly "Science Area Electives," were introduced to enable "flexibility, choice, and early branching" within the GIRs and to help students explore career paths, and that lab subjects "would not be designed to teach specific subject matter or to provide broad coverage of a particular field; rather, they would be intended to give the students some real idea as to what laboratories are and what is meant by solving experimental problems in science and engineering" (Zacharias et al., 1964, p. 36, 37). These subjects have now been incorporated into major requirements and as a result, MIT's GIRs no longer have a mechanism that enables "flexibility, choice and early branching". We describe below existing and proposed offerings and strongly recommend the continued development of one-semester cross-cutting courses that integrate key disciplines and introduce some flexibility, starting with the SMC GIRs, but hopefully incorporating HASS GIRs in the future, as well. For example, integrated subject GIRs could enable students to engage with topics like climate change that inherently draw from multiple SMC disciplines.

Subjects should be developed by faculty in departments in consultation with downstream departments that require the class, possibly through the SMC subcommittee overseeing the requirements (see Governance). We propose that such courses would: 1) **Not be survey courses** and achieve the stated goals of the GIRs (above); 2) Introduce students to **discovery, innovative designs, and complex real-world challenges**; and 3) serve as foundational building blocks that cover certain topics reliably and at an intensity (6U or 12U) that can be prescribed by majors.

Process, Timing, Oversight

We propose that courses in this category will all offer a 6-unit 'exposure' course and/or an integrated hybrid course with one of the other disciplines in the category. For example, we recommend beginning with three integrated offerings, one of which already exists:

1. Computation + PSM
2. Computation + PSM + different science fields, which would be 6.100A along with 6.C01 + x.C01 where 12 of 18 units counts as GIR
3. An integrated Chemistry + Biology subject, to be developed

We propose that integrated offerings be developed by a variety of departments, providing a way for additional departments to contribute to the GIRs and providing students with different perspectives on these disciplines. For example, an integrated offering on chemistry and biology with input from Chemistry, DMSE, Biology, CEE, and EAPS is an opportunity to bring climate change directly into the GIRs. Precedent for this includes 7.014, which is currently co-taught between Biology and CEE. To ensure that subjects meet the rigor required of an MIT GIR, we propose that departments currently teaching the GIRs in question be asked to "peer review" any proposed new subject by the SMC committee during the evaluation process.

We propose students be allowed to take one of these integrated classes or two 6-unit exposure classes as part of their SMC GIRs, effectively allowing students to complete Chemistry, Computation, PSM, and Biology components of the SMC requirements using 36 units (i.e., 3 classes) with a combination of classes of their choice.

The final determination of course content and emphasis would be made by faculty and rest with the participating departments. Pilots should be designed starting in Fall 2027 that will serve to help departments decide how they want to set prerequisites for downstream courses and to improve the integrated and 'exposure' subjects before expansion to a wider cohort. Time will be needed to develop courses, so we suggest a launch as GIR options for a larger cohort in Fall 2028. Full-semester courses for each subject would continue to be offered so that majors can rely on foundational building blocks in these courses, and/or students who want more advanced content or who have heard excellent feedback about a particular course can take them.

Impact on existing courses

We expect that this new model would decrease enrollment in 3.091, 5.11x, and 7.01x relative to current numbers, with students spreading their choice among the varying intensity options, depending on interest and future plans.

Majors that rely on these courses as prerequisites can specify up to two of the four subjects that must be completed as non-integrated, full-semester 12-unit versions. As prerequisites for departmental programs, all 6-unit versions of the Chemistry, Biology, and Computation GIRs (either standalone or integrated with another subject) would be treated as equivalent, and all 12-unit versions would be treated as equivalent. Majors can choose to specify a particular PSM subject or a limited selection of PSM subjects, but doing so would use up their 12 units of overlap with the GIRs.

To support students who change majors or who are undecided about their major when they take their SMC GIRs, we propose that departments offer “catch-up” options, if needed, that cover the difference in material between the 6-unit and 12-unit GIR versions. Options may include standalone classes during the semester or IAP, online materials with Advanced Standing Exams, 6-unit classes that meet with the 12-unit versions (either throughout the term or limited to the second half), or other strategies deemed appropriate by the relevant departments.

AP or ASE credit

AP or ASE credit being offered for this requirement would be at the discretion of the subcommittees overseeing the requirement.

Chemistry

TFUAP believes that Chemistry remains a fundamental discipline, both providing unique ways of thinking and providing essential literacy for understanding the molecular world. We believe that continued attention should be paid to ensuring that 3.091 and 5.111 are taught effectively so that all MIT students can build on a foundation in chemistry early in their time at MIT, and that integrated flavors or the exposure subject will serve as a foundation for students not relying on the subject for further academic work at MIT. In addition to the solid state, there are biological applications of chemistry that could be highlighted through an integrated Chemistry and Biology course. Chemists are also taking advantage of computation to simulate and predict molecular reactions, which could be highlighted in a Chemistry and Computation course. Such interdisciplinary offerings would possibly be suitable for multiple downstream majors, emphasize the convergence between fields and enable students to see how making unexpected connections between disciplines drives innovation in human knowledge.

Biology

TFUAP believes that Biology also remains a fundamental discipline - both providing unique ways of thinking - e.g., genetics, evolution - and providing essential literacy for understanding the living world, including ourselves. We believe that continued attention should be paid to ensuring that 7.01x’s are taught effectively so that all MIT students can build on a foundation in biology early in their time at MIT, and that integrated flavors or the exposure subject will serve as a foundation for students not relying on the subject for further academic work at MIT. Furthermore, chemistry elucidates biology by enabling a deeper understanding of biomolecular structure and function, which could be highlighted through an integrated Chemistry and Biology class. Biology is also taking advantage of the latest computation and machine learning technologies, which could be highlighted through an integrated Biology and Computation class.

Computation

Rationale

In 2017, the Working Group on Computational Thinking concluded that: "Computational thinking should play an explicit role in the formal education of all undergraduate students at MIT. Computational thinking provides a distinct type of rigorous thought of intellectual value; it requires and develops important modes of communication; it acknowledges the need to understand the transformational impact of computation in other disciplines; and it creates opportunities and access for our students and graduates."

These findings from 2017 have only been reinforced in the years since. Computation has continued to transform the disciplines that MIT undergraduates study and the full spectrum of professions that they enter as graduates. Programming, algorithms, machine learning, and generative AI are fast becoming essential skills and ways of thinking for the current century, as calculus and differential equations were the foundation of engineering in the last century. In an Addendum to the Report of the Working Group on Computational Thinking shared with TFUAP, it was noted that among the 4,912 unique graduates in the classes of 2019 to 2023, 4,130 (84%) earned at least one S.B. with an explicit computational requirement (1,063 earned two S.B.'s), and many of the remaining 16% chose to take a computation class, leaving just 9% without formal exposure to computational thinking.

One potential criticism addressed in the 2017 Working Group's report is that a computing GIR is not needed, since >90% of MIT students already take such a class. However, this means that computing is already serving the "Foundational Building Blocks" function of the GIRs. That group noted that MIT's GIRs also function as "a statement to our community and to the world of what MIT believes to be of the utmost importance in its undergraduate education." TFUAP echoes that argument, noting that the absence of computational ways of thinking from our GIRs sends a clear signal that MIT doesn't think computing is necessary in the 21st century, which is the exact opposite of the message we need to send. Our requirements should be communicating to K-12 and peer higher educational institutions that computing is essential, and that everyone needs to be teaching it. Similarly, our requirements should be telling employers and graduate schools that they can count on every MIT student to have facility in computational ways of thinking across a range of disciplines.

We also note that incoming students have had years of math and science during their K-12 education. In many schools, computing is an elective if it's offered at all, whereas students already have some requirement to take math, physics, chemistry, and biology in most US K-12 curricula, even if it's not at MIT's level. Students know they are behind, and they are using their scarce unrestricted electives to catch up. Furthermore, there is a recognition that computation is revolutionizing multiple fields. Acknowledging this convergence with interdisciplinary offerings would prepare our students to be the ones who make unexpected connections between fields and drive innovation in human knowledge.

Computing also needs to be in the GIRs to establish it as a course that students take early, in their first year or even first semester, as a foundational building block that covers certain topics reliably and at an intensity that can be prescribed by majors. Like Math, Physics, Chemistry and Biology we propose students take “some form” of computing by the end of year 2 so that instructors and departments are able to build on that foundation.

One may also wonder whether computing is becoming irrelevant with the advent of generative AI. However, we believe that this conflates computational thinking with the generation of program code. Saying "AI will take over programming" seems as simplistic as saying "digital calculators took over math." Digital calculators certainly do most of our arithmetic these days, but we still teach kids how to do arithmetic. Software like Mathematica and Wolfram Alpha has been used to solve algebra and calculus problems for decades, but we still teach students how to do that math for themselves. AI can solve an increasing number of science problems and generate text in a variety of styles – but we still believe that students should have science literacy and scientific ‘ways of thinking’ and learn how to structure an argument and communicate. AI will likely take over the writing of *straightforward* code, but students will still need computational thinking: understand how to translate a problem so it can be solved computationally, and how to recognize and debug incorrect algorithms.

Requirement

As a foundational building block for these skills, TFUAP recommends a new Computation requirement for all MIT undergraduates. We propose that subjects in this category will be: 1) a full semester 12 unit course; 2) a 6 unit ‘exposure’ course; and 3) an integrated course with one of the other disciplines in the category, which would allow students to see how computing is transforming certain disciplines. The courses that satisfy this requirement should include (1) instruction in a broadly-applicable, general-purpose programming language, so that many departments can use the subjects as foundational building blocks in their majors; (2) introduction to important kinds of algorithms and data structures, along with the analysis of their time and space behavior, to start forming the skill of selecting and adapting them to a problem; and (3) applications of computational modeling to problems in specific disciplines, which might include machine learning, simulation, or optimization.

Existing courses that satisfy these requirements include:

- 6.1000 Introduction to Programming and Computer Science (12 units)
- 6.100A Introduction to Computer Science Programming in Python (6 units) plus either:
    - 6.100B Introduction to Computational Thinking and Data Science (6 units), or:

- 16.C20/18.C20/9.C20/CSE.C20 Introduction to Computational Science and Engineering (6 units)

As generative AI is rapidly changing the practice of programming, enabling people with little or no programming experience to write code, the Computation requirement should continue to emphasize a deep understanding of algorithmic behavior, the ability to communicate that behavior through precise language, and at least reading fluency of a general-purpose programming language.

AP credit and ASE

The committee tasked with oversight of the Computation requirement will ultimately decide whether to allow AP credit or license an ASE. Currently, MIT does not give specific course credit for the AP Computer Science A or B test and offers an ASE for 6.100A only.

Probability, Statistics, and Machine Learning

Rationale

We live in an increasingly data-rich world, which has been transformed recently by developments in machine learning. MIT graduates need to understand the underlying basis for interpreting noisy data, both for preparation for their majors and as future citizens. Highlighting the importance of this preparation, many majors already have some sort of requirement or option governing probability, statistics, or machine learning[6]. Because probability, statistics and machine learning is already serving the “foundational building blocks” principle for many students and constitutes an essential area of literacy and set of tools in today’s world, here, we propose to formalize this requirement broadly across MIT in order to ensure that *all* our graduates have this knowledge.

Unlike the rest of the proposed SMC GIRs, instruction in probability, statistics, and machine learning occurs to varying degrees across all five Schools and the College, and techniques for doing so often rely on discipline-specific needs. Leveraging that existing wealth of expertise while ensuring all MIT graduates achieve a baseline level of literacy represents a novel opportunity for departments not historically involved in teaching the GIRs to play a role. While the specifics of the requirement prohibit the inclusion of classes that are exclusively relevant to a single department, TFUAP welcomes and encourages multi-department efforts that draw on discipline-specific examples to teach broadly relevant concepts. We expect these subjects will be dynamic, interdisciplinary, and exciting to develop and teach.

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[6] Depending on the criteria one uses, between 15-22 Courses require instruction in probability, statistics, and/or machine learning. Those majors collectively award between ~400 and ~850 degrees/year, making this requirement one of the most broadly distributed at MIT.

Requirement

We propose that this requirement be met by having students complete one subject from a list of subjects curated by a new subcommittee of CUP, the Subcommittee on the Probability, Statistics, and Machine Learning Requirement (SPSMR). Subjects meeting the requirement should have the following properties:

- Subjects must cover at least two of the three elements of probability, statistics, and machine learning. We are aware that it may be overly challenging to meaningfully provide a solid foundation of all three topics in 12 units or cover the basics of all three topics in 6 units, hence our choice of two.
- Subjects need to have substantial mathematical, broadly applicable content. As a GIR, these subjects are intended to be foundational rather than narrowly applied to a single discipline. That said, learning probability, statistics, and machine learning without reference to real-world examples does not make a whole lot of sense, hence the balance. We believe that at least ½ the course content should be foundational rather than applied.
- Subjects should build on the new computing GIR (it should be a prerequisite) and meaningfully incorporate computation. This will be natural in a subject that covers machine learning, but even a more classical probability and statistics subject should go beyond hand calculation.
- Subjects should count toward degree programs in at least two different departments, and ideally should be jointly taught. This provides multiple beneficial features – it provides some counter-pressure against the list of classes getting too long and specialized, and it promotes cross-departmental teaching and collaboration.

Existing subjects that may meet the requirement

While few subjects meet the requirement at the outset, many subjects could meet the requirement with some adjustment. Although we list some putative classes below, the SPSMR will have to evaluate each one against the specification to ultimately decide whether they qualify for the requirement or how they might need to evolve to do so. The list below is not intended to be complete, as it will be up to the SPSMR to consider the entire list of possible subjects.

- *6.3800 Introduction to Inference* covers aspects of probability, statistics, and machine learning, emphasizing computation. It counts toward multiple degree programs.
- *14.30 Introduction to Statistical Methods in Economics* teaches students probability and statistics with applications in economics and the social sciences.
- *18.05 Introduction to Probability and Statistics* teaches both probability and statistics, counts toward multiple degree programs, and uses computational tools.

Process, Timing, and Oversight

We propose that the requirement be overseen by the SPSMR, comprising approximately 10 faculty across the five Schools and the College, along with students and appropriate *ex officio* members.

The SPSMR will develop the initial list of subjects in AY 2026-27, which may involve working with instructors and departments to adjust existing subjects to meet specifications. After the list is complete, the SPSMR will continue to oversee the requirement, including evaluating new subject proposals and periodically (approximately every five years) reviewing existing subjects.

Impact on existing courses

Existing courses can specify that a subject on this list meets their major requirements; indeed, it is a requirement for subjects to be on the list that they meet the needs of at least two departmental programs. Thus, in some cases, this will provide extra space in a student's UG experience.

More importantly, we hope that majors will take advantage of the widespread knowledge of probability, statistics, and machine learning, and build on that in other classes in their departmental programs.

AP credit and ASE

We do not envision any AP credit (such as for AP Statistics) counting toward or an ASE being offered for this requirement.

REST and Institute Lab

The Restricted Electives in Science and Technology (REST) and Institute Laboratory (Lab) requirements were originally conceived as part of the overall collection of Science, Math, and Engineering GIRs. REST subjects, formerly "Science Area Electives," were expected to enable "flexibility, choice, and early branching" within the GIRs and to help students explore career paths (Zacharias et al., 1964, p. 37). Lab subjects "would not be designed to teach specific subject matter or to provide broad coverage of a particular field; rather, they would be intended to give the students some real idea as to what laboratories are and what is meant by solving experimental problems in science and engineering" (p. 36). While the Committee on Curriculum Content Planning, now known as the "Zacharias Committee," noted that both Science Area Electives and Lab classes could support sophomore-level study in the majors, they cautioned that departments should be able to prescribe at most 2 of the then-4 subjects. The 3-subject Science Area Elective requirement later became the 2-subject REST requirement when biology was added to the science core, and the current rule is that at most 1 of the 2 REST subjects may be completed in a student's major. However, departments are allowed to specify up to three GIR subjects, and many choose to require one REST and one Lab subject within their department and one REST subject in a foundational area such as math or computing that serves the department's needs. As a result, students often give little thought to REST and Lab requirements and treat them as simply required classes in their majors.

Given this evolution of the REST and Lab requirements and our proposed change to incorporate a "flexible foundations" category for GIRs, TFUAP recommends eliminating both requirements. We still endorse the goals of both requirements, but feel that other proposed requirements will better serve these goals. Our revised SMC GIRs incorporate more unique areas of study than the prior science core, adding some engineering and computing content and therefore enabling broader exploration within the core. Likewise, the updated math requirements and new computation and probability, statistics, and machine learning requirements provide a broadly useful foundation for further study in most engineering and science fields.

The goals of the lab requirement, meanwhile, have been reimagined for an era in which more than 90% of students engage in UROPs before they graduate (the UROP program did not yet exist at the time of the Zacharias report). We also expect that most departments would preserve lab classes as part of their majors, recognizing the value of hands-on learning and working on projects that approximate the work of a professional in that field. TFUAP's focus is instead on ensuring that experiential and project-based learning is high-quality and recognized, and a new teamwork-intensive requirement, updates to the communication requirement, new pedagogical initiatives, and opportunities like faculty-mentored UROPs and the Mens et Manus Scholars program will all support that goal.

Impact on Major Requirements

REST and Lab have, for many years, been used by majors to effectively increase their maximum size from 12.5 subjects as specified in the Faculty Rules and Regulations to 15.5 subjects, relying on a rule that allows departments to "specify" up to 36 units of GIR subjects.

Given the new proposed requirements and the need for many majors to continue to require the classes previously included in these categories, TFUAP proposes the following:

- The maximum major size will be raised from 12.5 subjects to 14.5 subjects.
- Departments will be allowed to specify up to 12 units of GIR subjects. We expect that this may include a Probability, Statistics, and Machine Learning (PSM) subject, a Teamwork-Intensive subject (described below), or a HASS subject.

TFUAP feels that this new approach to major sizes will grant the majors more flexibility in their requirements without overly constraining student choice within the GIRs and without negatively impacting the number of unrestricted electives available to students.

At the end of this report, we provide a detailed assessment of the impact of our consolidated recommendations on existing courses. We found that majors should not be constrained if they allow modest changes to incorporate some of the new requirements (like allowing the new computing class to substitute for their existing computing requirement).

2B: HASS

Rationale

The humanities, arts, and social sciences are more important than ever. We live in a world where social, political, technological, economic, and environmental changes are accelerating, sometimes exponentially. Our lives and communities are rapidly becoming more complex and more diverse, but often with more silos. The world and the social systems that we collectively want for a digital age may be quite different from the systems that have been built for an industrial age. Our most pressing challenges are multisystemic. Meeting these challenges requires a broad understanding of human creativity, socio-cultural, economic, and political phenomena, and of how to engage constructively with others about moral and social questions.

Given these needs, TFUAP strongly affirms the fundamental importance of the humanities, arts, and social sciences to general education. And as new questions for these disciplines continuously emerge with developments in artificial intelligence and automation, MIT must equip students with the tools and frameworks for "human intelligence" supported by the HASS requirement – critical reasoning, creativity, communication, and moral, intellectual, and aesthetic judgment.

As described in the MIT Bulletin, MIT's requirement in the humanities, arts, and social sciences aims to equip students with a "broad understanding of human society, its traditions, and its institutions." The requirement seeks to enable students to deepen their knowledge in a variety of cultural and disciplinary areas and develop sensibilities and skills vital to an effective and satisfying life as an individual, professional, and member of society. SHASS departments and units consistently rank as some of the very best in the world. The foundational report provided for the task force's internal use by the Subcommittee on the HASS Requirement (SHR) notes that HASS instructors are dedicated, creative, and passionate about their research and teaching, HASS subject offerings and concentration fields are robust, and students have an abundant amount of choice as they navigate the requirement and pursue their HASS interests.

The requirement is structured to provide both breadth across HASS via the three-subject distribution requirement and depth within a HASS discipline via the three-or-four subject concentration.

The SHR report nicely articulates the breadth requirement:

> "Students gain general knowledge of the humanities, arts, and social sciences through completion of the Distribution Component. To ensure breadth, students must complete three subjects, one from each of the following categories: Humanities (HASS-H), Arts (HASS-A), and Social Sciences (HASS-S).

The SHR report goes on to describe the concentration:

> “Students gain a deeper understanding of a humanities, arts, and social sciences subfield through completion of the Concentration Component. To ensure depth, students designate a field of concentration and complete three or four subjects (some fields require three, some four) that together provide an increased knowledge and understanding of the issues and methodologies in a particular area of study.”

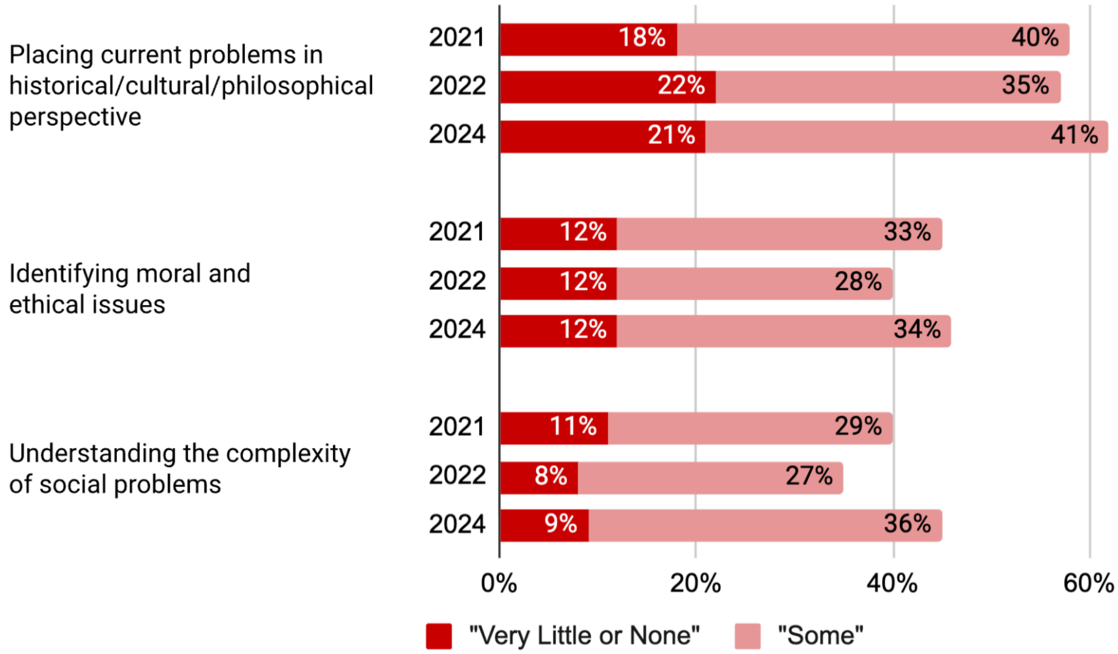
Generally, the task force believes that the HASS requirement works well. However, students can and do satisfy the current HASS GIR requirements through combinations of classes that enable them to graduate without all of the essential capabilities, knowledge, and habits of mind that are provided by the offerings in the humanities, arts, and social sciences. Graduating MIT seniors demonstrate this variability when reflecting on their MIT learning through the Senior Survey, with many students noting that MIT did not contribute to their learning on certain key learning outcomes (Figure 4). In particular, while many graduating students did feel that their experience at MIT had contributed to their ability to understand moral and social issues and to put them into historical, cultural, and philosophical context, a significant fraction– between 35 and 62 percent – felt that their MIT experience had contributed only some, very little, or none to their capacities in these areas.

During our listening tour, TFUAP heard repeatedly about the importance of education in moral and social issues from groups across all MIT Schools and across faculty, staff, and students. This is consistent with the findings of the SHR report, which states that “there also appears to be a desire across the Institute to incorporate ethics and other contemporary topics into the curriculum." This is also consistent with the report from the Task Force 2021 and Beyond, which calls on MIT to “fulfill our public responsibilities and imbue our values and ideals more fully in our community and culture and in the education of our students” (p. 7).

In its review of MIT’s undergraduate academic program in 1949, the Lewis Report stated that “the first objective of education is to develop in students a sense of values in order that they may have those qualities — wisdom, judgment, tolerance, independence of thought, and critical sense — that mark an educated man” (p. 89) and noted the central role of subjects that are “humanistic in their spirit, outlook, and content” (p. 99) in developing this sense of values and soundness of judgment that all MIT students should cultivate (Lewis et al., 1949). It is clear that there are many subject offerings in the humanities, arts, and social sciences that support students in developing these capacities. TFUAP’s recommendations below aim to ensure that students take a combination of classes that provide an **explicit opportunity** to focus on developing a sense of their values as well as their civic and moral commitments, gain knowledge about ethics and civic engagement in different historical and cultural contexts, and apply these to real-world social and ethical questions with an understanding of their social, economic, and political contexts..

Figure 4

To what extent has your experience at MIT contributed to your knowledge, skills, and personal development in the following areas?



Data from 2021, 2022, and 2024 Senior Surveys conducted by MIT Institutional Research. Remaining response options were "quite a bit" and "very much."

Beyond the issues surrounding education that supports the development of moral, ethical, and civic capabilities, the feedback that TFUAP has received from students and faculty suggests that

- Students often do not understand how the methods, practices, and skills they learn in an individual HASS subject, or how the discipline represented by an individual subject, apply to other areas of their education or other domains in their lives.
- Students often do not know how to select HASS subjects that augment their existing capabilities and the education they are receiving through their other GIRs and their major programs.
- Their advisors share many of these challenges.
- Because students and advisors are unclear about how best to structure their education in the humanities, arts, and social sciences in ways that connect to the students' development as humans, citizens, and experts, they rarely prioritize HASS subjects when they build their class schedules. Instead, many students start by identifying the science core GIRs and the classes in their major that they want to take. Only after they finalize these classes do they look for HASS subjects that fit into the remaining time slots. Often, HASS classes are also chosen based on median reported work hours from subject evaluations.
- Many students consider HASS a secondary rather than an integral part of their MIT education.

Requirement

We propose that students continue to be required to take eight HASS subjects and that the existing distribution and concentration requirements remain the same.

As now, students will be required to take one subject from each of the following three categories (as described in the MIT Bulletin):

- Humanities. Humanities subjects describe and interpret human achievements, problems, and historical changes at individual as well as societal levels. Although humanist inquiry employs a variety of methods, such disciplines as history, literature, and philosophy typically produce their accounts of cultural accomplishments through close analysis of texts and ideas: contemporary and historical, personal and communal, imaginative and reflective.

- Arts. Arts subjects emphasize the skilled craft, practices, and standards of excellence involved in creating representations through images, words, sounds, and movement (e.g., sculptures, stories, plays, music, dance, films, or video games). Although arts subjects also engage in critical interpretation and historical analysis, they focus more centrally on expressive and aesthetic techniques and tools, such as the uses of rhythm, texture, and line.

- Social sciences. Social science subjects engage in theory-driven as well as empirical exploration and analysis of human transactions. They address the mental and behavioral activities of individuals, groups, organizations, institutions, and nations. Social science disciplines such as anthropology, economics, linguistics, political science, and psychology seek generalizable interpretations and explanations of human interaction.

The Concentration remains three or four subjects. At least one should be an upper-level subject.

In addition to the existing distribution and concentration requirements, TFUAP recommends that students must also take at least one subject designated as a Moral and Civic Perspectives subject in a way that is analogous to the CI-H designation. Like CI-H subjects, Moral and Civic Perspectives subjects may also simultaneously satisfy a distribution, concentration, or elective requirement.

We propose that Moral and Civic Perspectives subjects systematically explore how individuals, communities, and societies grapple with questions of value, virtue, responsibility, significance, community, justice, and the greater good. We recommend Moral and Civic Perspectives subjects have one or more of the following as one of their **primary** learning objectives:

- Understand and evaluate diverse theories about right and wrong, and learn how to apply them to difficult questions in rigorous, disciplined ways

- Analyze how ideas about values, ethics, and civic responsibility emerge from and transform the economic, social, and cultural contexts in which they are embedded
- Explore real-world ethical dilemmas and develop practices of critical reflection about the alignment of one's values and commitments with one's decisions and actions in one's personal, professional, and public lives

Process, Timing, and Oversight

We recommend that HASS requirements continue to be overseen by the SHR. Ideally, each of the categories would be represented and reviewed by at least two faculty members from different departments who have experience teaching in that category.

SHR will be charged with developing a process for certifying Moral and Civic Perspectives subjects, along with the initial list of subjects in AY 2026-27, which may involve working with instructors and departments to adjust existing subjects and develop new subjects to meet specifications. After the list is complete, SHR will continue to oversee the requirement, including evaluating new subject proposals and reviewing existing subjects every five years. This may also entail increasing SHR's meeting cadence and member capacity.

Our proposed Moral and Civic Perspectives requirement should undergo annual reviews by SHR and an interim review by CUP after approximately 5 years, with a comprehensive evaluation for effectiveness approximately 10 years after implementation. This would allow assessment of ~6 graduating classes. Of course, although we ultimately care about how the requirement affects students well after graduation, that would require waiting 15-20 years, which is too long. As SHR develops the certification process for Moral and Civic Perspectives subjects, we encourage them to develop strategies to assess the effectiveness of the requirement. The evaluation of the requirement should be undertaken by an independent body, such as CUP or an ad-hoc committee. The results should be shared with the community and used to continue, revise, or abandon the requirement.

Why Eight Subjects?

While conversations with the MIT community have highlighted a near-universal support for requiring HASS subjects for all MIT students, some community members have questioned whether it is necessary to require eight subjects, suggesting that a six or seven-subject requirement might achieve the same aims while freeing space for other objectives. TFUAP discussed the possibility of reducing the size of the HASS requirement but ultimately concluded that an eight-subject requirement was appropriate.

The eight subjects in the HASS requirement are not a monolith. The first half of the requirement provides a broad foundation, exposing students to multiple disciplines with unique objectives and scholarly traditions. The second half adds depth, requiring students to develop greater fluency in a particular discipline or cross-disciplinary field through repeated exposure over multiple subjects.

While these two parts of the requirement could be completed in 6 or 7 subjects, requiring 8 gives students the bandwidth to explore through one or two electives before deciding on a concentration or to pursue interdisciplinary subjects that do not satisfy either the distribution or concentration requirements. Building in flexible subjects by design also reduces the pressure to maximize each subject, instead selecting subjects based on intellectual curiosity.

Some community members have also highlighted the value of requiring eight HASS subjects over what is typically an eight-semester undergraduate program. Given the distinct ways of working and learning within HASS fields as compared to STEM fields, students and faculty alike have noted that taking one HASS subject alongside three to four STEM subjects provides a useful intellectual balance, complementing problem sets and projects with the reading, writing, and discussion common to HASS subjects, and helping to integrate their scientific and technical learning with humanistic education. That said, this experience is not universal; many students major in non-STEM fields or take multiple HASS subjects in some semesters and no HASS subjects in others.

Adding Flexibility in HASS

While TFUAP ultimately decided that the HASS requirement should remain 8 subjects, we recommend the following steps be taken to give students more flexibility in how they complete those subjects:

1. Departments offering HASS subjects should encourage the creation of more HASS subjects during IAP. HASS classes that benefit from the intensive timeline, opportunities to travel, or the curious and creative spirit of IAP are especially encouraged to consider IAP offerings.
2. Departments should consider granting AP, IB, and/or ASE credit for introductory subjects in their fields when an appropriate examination is available or, in the case of ASEs, could be created. Depending on how closely the test maps to the material and skills covered in an existing MIT course, a satisfactory test score could offer credit for a HASS elective, a distribution requirement (if a comparable class counts for that requirement), or an introductory subject in a concentration. This determination would be left to the department(s) with the relevant expertise. TFUAP notes that granting this sort of credit could encourage more students applying to MIT to study HASS subjects at a high level in high school and may encourage more students who excel in HASS subjects to apply to MIT. Students with credit for introductory HASS subjects may also opt to pursue more advanced HASS coursework upon arrival. TFUAP suggests that incoming credit for HASS subjects be limited to 1 or 2 subjects so that the vast majority are still completed while at MIT.

Other recommendations

In addition, TFUAP recommends that SHR, in consultation with HASS instructors, develop a strategy to inform students and advisors about the learning goals of the existing HASS-H, A, and S categories and offer guidance about how to select intellectually fulfilling HASS distribution and elective subjects. While advising is outside of TFUAP's charge, we recognize that better advising about HASS subject selection could address many of the concerns we heard from the community about how students approach the HASS requirement.

2C: Communication-Intensive (CI)

Rationale

The importance of students learning multiple types of communication came up broadly in TFUAP's 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 arose in TFUAP 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. Similarly, the idea of an "audience" has been complicated by technology, and graduates should have experience considering the different approaches needed to reach their target audience through different platforms and media.

We also noted that "communication" can often focus more on speaking/writing than listening and facilitating communication, 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.

Requirement

The number of CI-H/HW and CI-M classes and pacing requirements will remain the same. TFUAP recommends that the Subcommittee on the Communication Requirement (SOCR) update the criteria for CI classes to explicitly require at least some subjects to teach visual communication and communication to non-expert audiences. TFUAP recommends that these skills specifically be taught in CI-M classes, but leaves the exact implementation to SOCR's discretion.

TFUAP also recommends that SOCR embark on a period of encouraging and licensing expansive experimentation and innovation in CI classes. Experiments need not adhere to the current CI requirement, but should provide objectives, rationale, and evaluation strategy. MIT should provide resources to support this experimentation and documentation of lessons. Based on this period of study and experimentation, TFUAP recommends that SOCR update the guidelines for the communication requirement within five years.

Process, Timing, and Oversight

To ensure that every student learns visual communication and communication to non-expert audiences, SOCR will need to implement a process for embedding these skills in existing and new CI classes and recertifying existing classes. This may include a phased implementation process whereby departments are expected to revise one of their CI-Ms to meet the new guidelines within a shorter timeframe (e.g., by the fall of 2027) and will have an additional 2-3 years to update the remaining CI classes. SOCR should determine the specific timeline in consultation with Writing, Rhetoric, and Professional Communication (WRAP). MIT may need to hire additional instructors with expertise in visual communication, which would delay the timeline.

SOCR would be expected to encourage, license, and monitor experimentation in new and existing CI classes to reduce reliance on word counts and explore new ways to teach and assess communication. Experiments should explore a range of communication styles, genres, mediums, and audiences. AI may be incorporated as a tool when appropriate, and experiments involving AI should be conducted in consultation with the newly charged Task Force on AI in Teaching and Learning. Interpersonal communication skills such as debate, listening, facilitating, and providing feedback should be encouraged in experiments. SOCR will report annually to the CUP on these experiments and share lessons with CI instructors. Pending interest from faculty governance, SOCR may also report directly to the full faculty on an annual or biannual basis.

Within five years, SOCR will propose a revised set of guidelines for the communication requirement, considering both the implications of AI and broader goals around the types of communication MIT students should master, and present them to the full faculty.

2D: Teamwork-Intensive (TI)

Rationale

TFUAP's Learning Goal 4 states that "every MIT graduate will be able to work collaboratively in teams, give and receive productive feedback, and take on leadership roles." TFUAP feels that interacting with peers through impromptu conversations, idea exchange, and face-to-face communication and collaboration teaches vital lifelong skills and is one of the unique benefits of a residential college education. In addition, teamwork, involving groups (3+) of peers toward a common goal over a sustained period-, enhances students' abilities to engage with different perspectives (LG5) and practice critical listening and thinking (LG6). Much like communication, teamwork is a skill that should be explicitly taught and practiced.

Requirement

All MIT students will be required to take at least one "Teamwork-Intensive" (TI) subject during their time at MIT. TI subjects can be taken within or outside students' majors, but departments may choose to specify a TI subject as part of their major requirements.

To be designated as Teamwork-Intensive, a subject must include:

- Instruction on effective teamwork practices.
- One or more team-based assignments, where a "team" consists of 3+ students, that collectively comprise a substantial portion of the subject grade.

Process, Timing, and Oversight

We recommend a new Subcommittee on the Teamwork Requirement (STR) that be charged with establishing and maintaining a set of qualifications for a subject to be designated as Teamwork-Intensive. STR will also collaborate with TLL and other experts on teamwork to create teaching materials, such as sample team contracts, workshops on teaching teamwork, and Canvas modules to facilitate the rapid adoption of evidence-based practices for teaching and engaging in teamwork.

STR will work with departments to certify existing subjects as Teamwork-Intensive and ensure that enough such subjects are available to students before the requirement is implemented.

Based on a preliminary review of majors, TFUAP found that many majors already include team-based project classes and therefore would be able to implement a TI class with little to no changes to their curriculum. Other majors might need to make teamwork a larger part of a particular class, create a new TI class, or decide that their students should select a TI class outside of their major (similar to how Lab and REST have been used in non-STEM majors).

Resources and support for departments and instructors in the development of subjects to help build student's ability to work effectively in teams - already exist at MIT. For example, the new and ongoing work of the MIT Dialogue Collaborative (DC) formed by DSL & ORSEL, the Gordon Engineering Leadership Program (GEL), and the Center for Constructive Communication, among others. These programs provide both formal and informal opportunities for students to gain essential skills in active listening, empathy and understanding and can augment and support the development of teamwork skills in academic subjects.

2E: Physical Education and Wellness

Rationale

MIT has long had a Physical Education requirement for students to receive "the instruction and skills necessary to lead healthy, active lifestyles and to foster both personal growth and a sense of community through physical activity,"[7] and the requirement was expanded in the past decade to include instruction in wellness as well as physical education. The requirement has always been

[7] https://catalog.mit.edu/mit/undergraduate-education/general-institute-requirements/#physicaleducationtext

modest, requiring just 8 points, or four quarter-long classes, in total (there are two quarters in each semester, plus additional classes are offered during IAP).

TFUAP recommends expanding the Physical Education and Wellness (PE + W) requirement in order to: 1) Reinforce MIT's commitment to student wellbeing on campus; 2) Complement the laudatory work of Student Support Services (S^3); 3) Teach our undergrads lifelong skills to manage their wellbeing; 4) Create space for students to explore both traditional physical education and wellness-focused offerings.

Many students currently satisfy the full requirement through the 4-course Pirate Certificate or participation in varsity sports, and TFUAP encourages them to use the additional 2 points to take a wellness-focused class to round out their PE+W experience. TFUAP also received many creative and compelling white papers discussing ways to teach wellness concepts to students, and we believe that a slight increase in the requirement, along with a corresponding increase in funding, will enable these new offerings and ensure that students make time to participate.

Requirement

Increase the PE + W requirement to a total of 10 points (5 quarters and 2 more points than currently required). Encourage students to complete at least 2 points in a class that focuses on some aspect of wellness.

Process, Timing, and Oversight

Depending on the amount of excess capacity in the current PE + W classes, this change could be implemented immediately or may require a year to develop additional classes and hire additional instructors. Resources devoted to PE + W classes should be increased, particularly for popular subjects, to ensure that students have sufficient opportunities to complete the requirement. New offerings, including wellness-focused offerings leveraging expertise across campus and non-traditional ways to earn PE + W points, such as through relevant first-year seminars and intensive weekend-long programs, should be encouraged.

2F: Experiential Learning

Mens et Manus Scholars

Rationale

TFUAP specified in our goals that an MIT education should include experiential learning and hands-on making/breaking (process goal 3), experiences that many community members described as quintessential parts of an MIT education. Rather than enforcing these experiences as requirements, which could create unnecessary rigidity around something that nearly all MIT students already seek out voluntarily, TFUAP proposes that a better approach is to recognize and create a community for the students who go above and beyond in these experiences.

Description

We propose the creation of a new Mens et Manus Scholars program that will be rigorous in admissions requirements but not limited in size, such that any MIT student can participate if they fulfill the requirements. We recommend that the exact criteria to become a scholar be determined by the oversight committee, but may include some or all of:

- A portfolio of projects completed in coursework, makerspaces, and/or experiential learning experiences
- A letter of recommendation from a faculty mentor, such as an instructor, UROP supervisor, or Head of House
- A written reflection describing the work they did and what they learned from it

Collectively, the application materials should illustrate a substantial long-term commitment to hands-on work, but the application requirements should be deliberately flexible to accommodate a variety of types of experiences.

The specifics of the program, including its requirements, activities, and even name, should be determined by the Mens et Manus Scholars Committee with input from the MIT community, but the goal would be to establish a community of students that:

- Is prestigious but not exclusive
- Feels like an honor and not a requirement or burden
- Engages in activities such as seminars, trips, exhibitions, etc., that add value to the student experience

For comparison, we highlight the Burchard Scholars Program in SHASS, which recognizes excellence in HASS disciplines and engages Scholars in intellectual conversation and community with faculty and other peers passionate about HASS. While the format of dinner seminars is likely not the best fit for the Mens et Manus Scholars, we hope the spirit of the program will be comparable. Students have shared that they feel honored to participate in the Burchard Scholars program and find the seminars fulfilling, but that students do not go out of their way to compete for spots in the program, which is a balance that we hope the Mens et Manus Scholars will also strike.

A Mens et Manus Scholars Committee, administered by the Office of Experiential Learning (OEL) and composed of experiential learning staff, faculty, and students, will maintain a rubric for reviewing applications, review and decide on applications each year, and publish a list of inducted members.

OEL and faculty governance would collaborate to identify committee members and draft a committee charge. The initial committee would finalize the program's requirements and determine how membership in the program should be recognized.

Faculty-Mentored UROPs

Rationale

One of TFUAP's goals was to "provide meaningful mentoring relationships" (Process Goal 5). For students, these relationships serve many purposes, including career and academic advice, letters of recommendation, personal support, and introductions to academic and professional connections. Besides academic advising and small classes, one of the key environments where these relationships are formed at MIT is in UROPs. That said, many UROPs are, quite reasonably, directly supervised by graduate students or postdocs. This structure creates more opportunities in popular labs, provides opportunities for graduate students or postdocs to learn supervision and mentoring practices, and may be more comfortable and supportive for students who feel intimidated by working directly with faculty. However, working exclusively with a graduate student or postdoc means that the undergraduate student does not benefit from the wisdom, connections, and potential letters of recommendation that a faculty member who knows them well could provide.

To encourage the creation of more UROPs that are directly mentored by faculty members, we propose the creation of a dedicated direct funding pool that gives priority to faculty-mentored UROPs.

Description

A faculty-mentored UROP would be defined as one where the undergraduate researcher's direct supervisor is a faculty member. Additional supervision may be provided by more experienced undergraduates, graduate students, postdocs, or research staff, but the faculty member would be responsible for meeting with the student to discuss their work at least every other week in a typical semester or weekly during the summer. As part of their UROP proposal, students would describe the expected mentoring structure (meeting schedule, mentor/mentee expectations, additional supervisors/mentors, etc.) as agreed upon with the faculty member. At the end of the term, students participating in faculty-mentored UROPs would be expected to complete a form noting how many times they met with their faculty mentor and what sorts of support that mentor provided. Faculty members who did not meet with students often enough (at least 6 times in a regular term or 10 times during the summer) would be ineligible for this pool of direct funding in the subsequent semester.

Process, Timing, and Implementation

TFUAP recommends that the UROP office consider how it might implement a split-pool model for direct funding and how much to allocate to each pool to balance the goal of increasing direct faculty mentorship of UROPs with other UROP funding goals.

Depending on capacity and other considerations, the UROP office may want to implement features such as mentoring contracts, caps on the number of students per faculty member, or mandatory or recommended mentoring training for participating faculty.

3: Policies

The collection of policy proposals that follows addresses many parts of the undergraduate educational experience, including registration, classroom policies, and more. Each is designed to solve a problem that we heard from the MIT community through our listening tour and white papers. The overarching goals of these policy changes are:

1. Clarity: Increase transparency and reduce complexity whenever possible.
2. Commitment: Refocus the classroom environment on high-quality in-person learning.
3. Compassion: Reduce unnecessary stress for students, instructors, and advisors.

Many of these policies are designed to work in tandem and reflect our commitment to supporting both parties in the student-instructor relationship.

3A: Clarity

The following policies are meant to reduce uncertainty and complexity for both students and advisors by increasing transparency and eliminating a legacy rule that disparately impacts certain departments.

Abolishing Non-Overlap Guideline

Problem

We heard from at least one department that the "non-overlap" rules enforced by the Committee on Curricula (Section 10.4.1 in the CoC Guidelines) and codified in major degree charts harm students in their major. TFUAP feels that students should be given the freedom to double-count subjects for their majors and GIRs, provided that the subjects fully satisfy the learning objectives of both requirements.

Proposed Policy

TFUAP proposes removing Section 10.4.1 from the CoC Guidelines and instead allowing students to count subjects taken for any major or minor towards their GIR subjects if applicable.

Considerations

- TFUAP recommends preserving Section 10.4.2, which allows departments to specify up to three GIRs and therefore impacts the overall size of major programs.
- Students would still be expected to complete a total of 32 subjects (GIRs plus "units beyond the GIRs"), but may be able to allocate a larger portion to unrestricted electives.

Posting Syllabi

Problem

Students are often unaware of what a class entails when registering, and some will register for classes solely to access the Canvas site or syllabus, leading to confusion about which students genuinely intend to take the class and creating extra work for students, advisors, instructors, and anyone else involved in approving student registration.

Proposed Policy

All subjects in the Subject Listing and Schedule (with limited exceptions for independent studies, special subjects not currently in use, etc.) must include a link to the latest class syllabus. For subjects that have been previously offered, this can be the syllabus from the most recent semester. For new subjects, this can be a draft syllabus. In either case, the linked syllabus should be updated to the current version no later than Add Date. Syllabi may be fully public or visible to anyone with Touchstone login credentials, but should be visible to all MIT students and employees.

Considerations

While the Subject Listing and Schedule is currently the most universally applicable location for syllabi, this is subject to change as MIT systems evolve. The Registrar's Office, in consultation with faculty governance, should be responsible for deciding on and updating departmental administrators about any changes to syllabus posting policies.

Interim Grade Reports

Problem

Students have shared that some instructors fail to return graded assignments or provide any information about grades until the last few weeks of the semester, leaving students with no time to drop the class or modify their performance if their grades are unexpectedly low.

Proposed Policy

All instructors will be expected to provide an interim grade report directly to students (via Canvas, website, or email) no later than one full week before Drop Date. At minimum, the grade report should entail a flag for students who are performing at a D-level or below (similar to current fifth-week flags for first-year students), indicating that they are at risk of failing, and a separate flag for students performing at a C-level. A more detailed grade report may include the current calculated grade based on graded assignments thus far, or a projected final grade based on demonstrated performance, and a narrative description of how the grade might change based on subsequent performance.

Instructors would also be required to return grades within a timely manner (e.g., within 2 weeks) to ensure that students have timely feedback on their performance.

Considerations

1. It may be appropriate to set a percentage of assignments (based on weighted point values) that must be included in interim grades. TFUAP has suggested 30-40% may be appropriate, but further study of syllabi and consultation with faculty is necessary to determine an appropriate number.
2. Insufficient or missing interim grade reports should be valid grounds for a late drop petition.

3B: Commitment

The following policies are meant to ensure that both instructors and students commit to participating fully in an in-person learning environment. While many of these policies also support the goals of clarity and/or compassion by reducing uncertainty and therefore stress for students, instructors, and advisors, these policies are connected by their direct impact on how early and fully students and instructors commit to MIT classes.

Registration Timing

Problem

The current Pre-registration system creates significant administrative overhead without delivering reliable benefits. Students frequently change their minds between pre-registration and registration, which undermines the accuracy of enrollment predictions used for faculty/TA allocation, classroom assignments, and resource planning.

Proposed policy

Students meet with their advisors in week 8 or 9 of the semester (late October/early November for fall and late March/early April for spring). Registration would open around week 7 or 8 and would close at the end of the semester. Lotteries and section assignments would be conducted immediately after registration closes, before the start of the next semester. Add/drop rules would remain in place, beginning at the start of the next semester, though Add/Drop deadlines would be shifted (see below).

First-year students would continue to register at the start of the semester. Sophomores declaring majors would register with their first-year advisors. To support them, departments would publish proposed "standard subject roadmaps" for majors so that sophomores can make informed choices.

Considerations

1. Departments would be expected to finalize teaching assignments early enough to ensure scheduling of all classes, while still allowing some flexibility for adjustments to individual instructors.
2. All courses would be required to have up-to-date syllabi available in the subject listing, with draft versions posted for new courses.
3. Special subjects would need to be proposed far enough in advance to appear on official schedules, as subjects relying solely on late adds should be discouraged.
4. Common first-year subjects with limited enrollment, such as CI-HW subjects and other limited enrollment GIRs, would have space reserved (estimated based on prior years' enrollment for comparable subjects) for incoming first-years in the fall semester, so that they are not disadvantaged by registering later.

Shifting Add Date and Drop Date

Problem

MIT has much later Add and Drop Dates than many, if not most, peer schools. While this allows flexibility for students, it can have a detrimental effect on classroom dynamics, particularly when groupwork is essential to the course. Advisors have also noted that students commit to too many classes and decide late in the semester to drop one, when the student would likely have been better off committing to fewer classes from the start.

Proposed Policy

Shift Add Date from the fifth week of classes to the fourth week of classes. Shift Drop Date from the eleventh or twelfth week of classes to the ninth week of classes. This shift should be done gradually over 3-4 years, shifting one week earlier each year, with the CUP monitoring the effects.

Considerations

1. We did not look at half-term subject add/drop dates because they were not noted as concerning by stakeholders, but it may be appropriate to shift these earlier as well.
2. Before shifting Drop Date forward, an interim grade report policy should be in place to ensure that students have the information they need to decide whether to drop a class.

Scheduling and Double-Booking

Problem

Roughly 15% of students (see Appendix D) in any given semester are registered for at least two subjects that meet at the same time. This behavior, known as "double-booking," prevents students from participating fully in both subjects, but may be necessary to maintain academic progress.

One reason for double-booking is that scheduling is highly distributed across departments and instructors, with little or no coordination to minimize conflicts for students. A symptom of this distributed scheduling is the large variety of time blocks used for courses. Although the Registrar's Office recommends a set of standard time blocks for lectures (MWF for one hour starting on the hour, or TR for 1.5 hours starting at 9:30, 11, 1, or 2:30), more than 50% of three-hour-per-week lecture subjects don't use these time slots at all (see Appendix D). A subject that meets at an unconventional time, such as TR10-11:30, overlaps with two conventional time blocks, creating additional conflicts for enrolled students and leaving classroom space empty before and after class time.

Proposed Policy

1. Scheduling: To effectively address the double-booking problem, MIT should schedule subjects deliberately to minimize conflicts between subjects that students want to take in the same semester.

   First, all classes must be scheduled within standard time blocks, which will be determined by the Registrar's Office to include an appropriate number of hour-long and hour-and-a-half-long blocks. Classes that need to be longer for pedagogical reasons can use a combination of consecutive blocks, provided that they submit a rationale. Recitations and labs will be encouraged to use standard time blocks, but will only be required to do so if students do not have multiple section times to choose from.

   In addition, the Registrar's Office will make data available to departments and instructors to help them choose times that reduce conflicts, such as historical co-registration (number of students taking subject A and subject B in the same semester) as well as *desired* co-registration (students preregistering for A and B, but forced to take only one in the end to avoid double-booking).

2. Double-booking: After the new scheduling policy has been in place for at least two years, MIT will ban the practice of "double-booking" classes for all undergraduate students. Students can petition to double-book classes and will be allowed to do so if their advisor supports the student's rationale for double-booking, and if the primary instructors for each conflicting class support the student's plan of how they will manage the conflict.

Considerations

1. Any scheduling policy should be assessed to ensure that conflicts do not get worse and to monitor unforeseen impacts. Decisions about time blocks should be made by a combination of Registrar's Office staff and faculty governance.
2. MIT's current registration system cannot prevent double-booking. Should this policy be adopted, formal enforcement cannot be done until a new registration system is in place. TFUAP recommends that the capacity to flag, disallow, petition, and override the double-booking policy should be included in whatever registration system MIT adopts.
3. After implementing the ban on double-booking, MIT should monitor the petitions submitted to see if common conflicts can be resolved by modifying schedules. If the petition load for certain classes becomes unmanageable for primary instructors, it may also be necessary to grant secondary instructors and course administrators the ability to approve and deny petitions based on general guidance from the lead instructor.

Resetting Classroom Expectations

Problem

There is a widespread sense that student engagement in their academic experience has decreased substantially in recent years. At MIT, double-scheduling of classes is common; instructors report that classroom attendance has decreased, and students in many classes are multitasking on their phones and laptops rather than engaging in learning. This behavior is not restricted to the pandemic, and is not unique to MIT (for example, Harvard, the Chronicle of Higher Education, a review in the *Int J. Ed Res.*).

Students are in residence at MIT because we believe there is value in *in-person learning*. Much learning and personal growth occur in the dorms and FSILGs. But learning, and its counterpart inspiration, also occur in class, and student attendance and engagement in class are pivotal for a residential campus.

This policy is intended to nudge the MIT culture back toward a focus on the academic experience by resetting the norms while allowing flexibility. Importantly, we believe that both students *and* instructors need to step up; the relationship between them needs to change, not that a single party is entirely responsible for the state of affairs. Instructors thus need to incorporate pedagogical practices that make the classroom an engaging, educationally valuable place to be.

Below, we propose classroom norms to be included in subject syllabi that aim to set expectations for both students and instructors. Instructors can amend the norms or choose not to use them at all. However, since the current norm is not to require attendance and to allow unfettered use of electronic devices, the lone instructor who deviates from this norm is at risk of being punished (or is worried they will be punished) in the course evaluations or by decreased student enrollment in their subject. We thus wish to change this norm in order to change the MIT culture through strength in numbers.

The proposed policy is modeled on the one used in MIT Sloan and informed by best practices from Harvard's Derek Bok Center for Teaching and Learning and a series of articles in the Chronicle on Higher Education.

Proposed Policy

In order to create a productive learning environment and ensure mutual respect, it is essential that the policies of classroom etiquette and behavior reflect the highest standards. It is also important that these policies be consistently enforced by instructors across all subjects. While each instructor is responsible for their own classroom, there are significant negative consequences for other instructors if policies are not consistently applied and enforced.

Therefore, it is the expectation of MIT that:

- Students arrive on time and stay for the entire class (see also *Scheduling and Double Booking* policy).
- Instructors begin and end class on time.
- Students attend all classes.
- Laptops, tablets, and phones remain closed/off except when explicitly allowed by the instructor, such as during class segments when this technology is used as part of the instructional program, or allowed as part of a DAS student accommodation.
- Instructors will adopt pedagogical practices that ensure that each classroom session adds educational value beyond what is offered in online materials (for example, by leveraging the resources of MIT's Teaching and Learning Lab).

It is expected that faculty will articulate at the start of the term how these expectations apply in their subject and how they will be enforced. Students who believe that instructors are violating policies as outlined in the subject syllabus should reach out to the department's undergraduate officer (or other designated individual).

Considerations

Dissemination

Proper dissemination is integral to widespread adoption. First, the President or Chancellor should send a message to the entire MIT community announcing the new expectations. Second, students should be made aware of the existence of the norms during orientation. Third, instructors should be made aware of the norms and examples of common variants during New Faculty Orientation or other onboarding procedures.

Exceptions

Any instructor may choose to adjust any aspect of this policy for their subject. For example, they may allow use of laptops for note-taking, or may spend part of the class time allowing laptops and the remainder in an activity that does not allow laptops. Instructors may choose not to require attendance and instead allow students to watch recorded lectures. These exceptions should be described in the subject syllabus.

3C: Compassion

The following policies are designed to reduce unnecessary stress around both high-stress times (final exams) and holidays meant to give students and instructors a break.

Replacing Fall Registration Day with a Holiday on the Wednesday before Thanksgiving

Problem

Students and faculty have shared concerns regarding Thanksgiving travel, noting that having class the day before Thanksgiving can make it logistically or financially impossible to visit family out of state without missing classes.

Proposed policy

Fall semester classes would begin on the Tuesday following Labor Day, turning the current Registration Day into a regular class day. The Wednesday before Thanksgiving would become a student holiday, with no classes held.

Considerations

1. This shift is easiest if Registration Timing (Section 3C) is moved earlier so that students can meet with their advisors during the prior term rather than on Registration Day. However, it can also be accommodated by asking advisors to meet with students to register for classes during the week preceding the first day of classes. Given that many students and advisors are not yet on campus during that week, many of these meetings would need to be conducted virtually. Alternatively, advisors could meet with students in person in the spring to discuss classes and then register asynchronously when registration opens in August.
2. Depending on the resulting distribution of class days, there may need to be a day when, for example, Monday classes are held on a Tuesday (perhaps after Indigenous Peoples' Day), similar to what is done following the Presidents' Day holiday.

Restricting Assignment Due Dates

Problem

Some instructors make assignments due on holidays or during/shortly after a major break, often cutting into students' time off. This manifests as de facto requirements that students work when they should have time away from academics.

Proposed Policy

Require that assignment due dates do not fall on a student holiday, the day before Thanksgiving, or the first business day after Thanksgiving or Spring Break.

Considerations

We recognize that this may lead to some compression of due dates in the days prior to breaks and later in the week after a break. Instructors are encouraged, but not required, to give students advanced notice of assignments and/or additional cushion around breaks to enable students to schedule work time and break time effectively.

Increasing Preparation Time for Finals

Problem

Some finals, particularly in the spring semester, fall only 3 days after the last day of classes. This often does not provide students sufficient time to prepare for finals. While we recognize that the academic calendar is highly constrained, there is a need to ease some of the pressure on students at the end of the spring semester.

Proposed Policy

To align the spring semester's last test date with the fall semester, the last test date should change from being the Friday before the start of the reading period (as specified in the Faculty Rules and Regulations) to whatever day is 5 calendar days before the last day of classes. If this date happens to fall during a weekend, the last test date will be the Friday before said weekend. Using the spring 2026 semester as an example, this would push the last test date from Friday to Thursday.

Considerations

Depending on how instructors choose to move their deadlines, this may lead to compression of deadlines on the last Thursday in the spring term.

4: Pedagogy

Expectation of high-quality instruction and a multi-year effort by the Teaching + Learning Lab and Open Learning -Residential Education to improve pedagogy

Student understanding and growth, and indeed, their learning in any single GIR can and should be supported, reinforced, and at times challenged by their learning in other GIRs. In our reimagining of the GIRs, we recognize this opportunity and provide the following recommendations for a pedagogical initiative that embodies a commitment to the shared responsibility and vitality of the

GIRs [Soicher]. The foundations of this initiative are the experiences and deep disciplinary knowledge of MIT faculty and lecturers, informed and modulated by the needs and interests of GIR home departments. The initiative brings together faculty, lecturers to explore how they can use the principles from the science of learning together with evidence-based teaching practices to support the design and delivery of individual GIR subjects. It facilitates intentional and meaningful connections across instructors, content, and pedagogy across these key subjects.

Support for the Design → Delivery → Analysis of New GIRs

Instructors of all new GIR subjects will be encouraged to participate in a multi-year, cyclical process of Redesign, Delivery, and Analysis - built on their disciplinary expertise - with support from the Teaching + Learning Lab (TLL), Open Learning Residential Education (OL-Res), and Open Learning's Disciplinary Experts in Learning Technology and Applications (DELTA) team (formerly Digital Learning Lab scientists & fellows [DLLs]). The participation of instructors from the first-year learning communities - ESG, Terrascope, Concourse, and DesignPlus - would also be encouraged and valued. This process will be grounded in the science of learning, evidence-based subject design and teaching, and classroom-based educational research. It provides incentives for individual faculty and departmental participation and creates structured opportunities for all GIR instructors to come together to build connections to enrich teaching and learning across the GIRs.

This initiative brings together faculty, lecturers, and instructional teams for the GIRs and staff from the Teaching + Learning Lab and Open Learning - Residential Education, and Open Learning DELTA and includes 3 key components:

- Course Adaptation & Design Institute (CADI), offered annually in early June
- Subject Support Teams (SSTs) for each new GIR
- Inter-Subject Community of Practice

Each of these components is described below.

Course Adaptation & Design Institute (CADI)

Instructors in new or revised GIR subjects, preferably in teams of 2-4 instructors per subject, will participate in a week of workshops in early June. Participants will have time in the workshops to work on course plans and revisions.

Facilitated by staff from TLL, OL-Res and OL-DELTA, participants in CADI will use the Backward Design[8] to:

- Develop subject-specific learning outcomes that align with the programmatic learning outcomes and TFUAP learning and process goals (as accepted by the MIT faculty).

[8] Wiggins, G., & McTighe, J. (2005). Understanding by Design (Expanded 2nd ed.). Alexandria, Virginia: Association for Supervision and Curriculum Development

- Create student assignments that meaningfully assess student learning (or progress toward articulated learning outcomes) and engage students in individual critical thinking and collaborative problem-solving. This will include considerations of GAI-aware assignments, assessments, and in-class work.
- Plan in-class teaching and learning activities that leverage the science of learning and evidence-based teaching practices to engage students and provide opportunities for deeper learning and more enduring understanding.
- Collaboratively discuss (with TLL research and evaluation experts) how to define success with respect to the reimagined subject.
- Develop plans to assess the impact and effectiveness of specific course design and delivery choices through the collection and analysis of relevant data, with the goal of informing and improving future iterations of the subject. Data sources may include syllabus/assignment analysis, classroom observations, instructor interviews, and/or student surveys & interviews.

CADI will emphasize evidence-based teaching techniques and therefore, will support nearly all of the TFUAP goals, including:

- Peer collaboration (Learning Goal #4)
- Scaffolding communication skills (Learning Goal #5)
- Critical thinking (Learning Goal #6)
- Relevance (Learning Goal #8)
- Peer support and community (Process Goal #1)
- Experiential learning (Process Goal #2)

As previously stated, all work in the CADI is founded on the knowledge and expertise of MIT faculty and instructors, informed by the needs and constraints of their departments and the MIT community, with support from TLL, OL-Res, and OL-DELTA.

Subject Support Teams (SSTs)

If requested, a new GIR subject will be assigned a Subject Support Team (SST) that includes staff from OL and TLL. SSTs will be available to support GIR faculty and instructors throughout the Design - Delivery - Analysis process. SSTs can assist in course planning, assessment design, the selection and use of in-class teaching and learning strategies, and follow-up subject assessments. They can also provide resources and workshops for TAs, and engage in collaborative discussions with the instructional teams about the data collection and analysis processes.

Inter-subject Community of Practice (ISCoP)

As stated in Tomasik, *"...a community of practice of GIR instructors will better coordinate the science core GIRs, provide more opportunities for instructor and student community building, train students in how to learn, increase the use of evidence-based teaching practices…and study the results of interventions for cycles of iterative change."*

In advance of each academic year, all new GIR faculty and lecturers will be invited to participate in the Inter-subject Community of Practice (ISCoP)

ISCoP will meet 2 - 3 times/ semester and 1 time each during IAP and Summer. It is designed to:

- Foster coordination and collaboration of GIR instructional staff across the institute
- Support the cross-subject reinforcement of key concepts in GIRs and the development of interdisciplinary teaching opportunities to enrich student learning
- Identify opportunities for concurrent presentation of shared content
- Provide a venue to compare and discuss subject policies (exam, grading, etc),
- Enable consistent application of the science of learning and research-based practices across GIRs
- Provide opportunities for discussion of successes and challenges in new GIR subjects, and to discuss options for future iterations (including potential opportunities for future/more robust collaboration)

ISCoP meetings will be facilitated by staff from TLL and OL.

Pedagogical Support for All Instructors

In addition to the initiatives for GIR instructors, described above, increased support for the design, delivery, and analysis of MIT subjects will also be available to all members of the MIT teaching community. These efforts will include:

- Course Adaptation & Design Institutes (CADI) - offered in early summer
- School-based New Faculty & Lecturer Cohorts - modeled after TLL's Kaufman Teaching Certificate Program
- Topic-based Faculty Cohorts - with topics based on faculty interest. See this poster for a summary of work from a past AAU-funded Evidence-based Teaching Cohort
- Departmental Action Teams to support substantive, instructor-driven change at the departmental level.
- One-on-One Consultations with a TLL Research & Evaluation team member to:
    - Discuss course design, delivery and assessment
    - Develop purposeful, measurable research questions and objectives
    - Design a study to address educational research questions and objectives
    - Collect and organize pertinent data
    - Analyze collected data using relevant and rigorous analytic approaches.
    - Interpret the findings to guide future decision-making.

Funding Considerations

Teaching Postdocs

The success of this initiative requires the hiring of teaching postdocs or graduate students in designated departments. These individuals will bring both expertise in the discipline and at least one additional skill in: learning sciences, learning analytics, curriculum and educational research, or in another relevant area. Funding for these positions would be shared by home departments and MIT. (Barnes)

Teaching postdocs are modeled after Open Learning's highly successful Digital Learning Fellows program (recently reconfigured as DELTA), which supports digital teaching and learning (among other things) within departments.

GIR Faculty & Lecturer Participants

Participating faculty and lecturers will be provided with discretionary funds and/or teaching relief during the first two years of the Design-Delivery-Analysis phase of the initiative.

Note: references and supporting materials for this section can be found in Appendix E.

Supporting Interdisciplinary Teaching

> *"True interdisciplinary teaching goes beyond just putting different topics side by side. ... it means weaving ideas, theories, and methods from many fields to examine a shared theme or question. This takes careful planning, a willingness to step outside your comfort zone, and a focus on working together. The aim is not to water down each subject but to strengthen them by showing how different ways of thinking can shed more light on tricky issues..."*

Hojiej, Z. (2025). Practical Strategies for Interdisciplinary Teaching in Today's University, *Faculty Focus*, 18 July.

Interdisciplinary Teaching Fund

TFUAP recommends the creation of a new fund specifically dedicated to supporting interdisciplinary classes involving instructors from at least two (and ideally three or more) departments. Applications to and administration of this fund would be similar to the Education Innovation Funds for Teaching and Learning or d'Arbeloff Fund, with a few noteworthy differences:

1. Applications to the fund must include instructors and corresponding letters of support from two (and ideally three or more) separate departments.
2. Applications should describe a plan for sustained offering of the subject after central support ends, such as through dedicating instructor time, TA, and other support, and incorporation into the majors of the offering departments.
3. Recipients would receive sufficient support to run the subject for at least three offerings, which may occur at any time within 6 years.
4. In addition to funding to support the development of the class itself, funding will be awarded to the instructors' home departments in exchange for the time the instructor spends teaching outside their department. Funding may be used to hire lecturers, TAs, or other teaching support as needed.

Interdisciplinary Connections in the GIRs

The first year at MIT, before students become locked into a single discipline, department, and/or program and their discipline-specific methods for analysis and problem solving, is a prime time to introduce students to interdisciplinary subjects. By engaging with interdisciplinary ways of thinking in the GIRs, students are better positioned to use multiple lenses and approaches to take on the complex problems and issues they encounter in more advanced courses in their chosen disciplines. See Newell, W.H. (1990, p. 79) for additional information.

The new proposed GIRs move away from traditional disciplinary siloes in multiple ways. The options for integrated flavors of science GIRs, Probability, Statistics, and Machine Learning GIR, and some anticipated Moral and Civic Perspectives subjects will all be interdisciplinary by design.

In addition to these structural approaches to engaging students in interdisciplinary learning, TFUAP expects the curriculum for the new SMC GIRs and Moral and Civic Perspectives classes to be developed with deliberate attention paid to connections among the subjects. This should involve reinforcing pre- or co-requisite subjects (e.g., relying on skills learned in the Computation GIR in other SMC subjects) as well as embedding explicit cross-references in subjects that students may take in either order (e.g., using Chem/Bio concepts to illustrate ethical questions raised in a Moral and Civic Perspectives class and describing the moral and social questions raised by a particular scientific discovery as it is introduced in the Chem/Bio GIR).

5: Governance

Given the relative infrequency of large-scale reviews of the undergraduate academic program and rapid advances in science and technology, including the rise of generative artificial intelligence, that impact what and how MIT students learn, TFUAP feels strongly that a more robust and nimble governance structure is necessary. To that end, we propose two types of committees, one to oversee the ongoing evolution of the GIRs to respond to changing needs and capabilities while maintaining fidelity to the original goals, and another to study and make recommendations regarding parts of the undergraduate program that demanded more focused study than TFUAP had the capacity to undertake. We also expect existing standing (sub)committees to steward aspects of this proposal, and we describe those expectations below.

New Curricular (Sub)committees

To oversee the creation and ongoing evaluation and iteration of the SMC GIRs and Teamwork-Intensive Requirement, TFUAP proposes the creation of three new ad hoc subcommittees of the Committee on the Undergraduate Program (CUP), which may eventually become 2-3 permanent subcommittees of CUP. These subcommittees would join existing CUP subcommittees, such as the Subcommittee on the HASS Requirement (SHR) and the Subcommittee on the Communications Requirement (SOCR).

The three ad hoc subcommittees would focus on:

- The Science, Math, and Computing requirement
- The Probability, Statistics, and Machine Learning requirement
- The Teamwork-Intensive requirement

Each subcommittee would begin on an ad hoc basis and focus on defining and implementing the new requirements. Following this initial 1-2 year startup period, the faculty officers and CUP will coordinate to define and charge permanent subcommittees to oversee long-term maintenance of these requirements. The permanent structure may also include three subcommittees with the same areas of focus (totalling five subcommittees of CUP alongside SHR and SOCR), or PSM could be absorbed into the SMC subcommittee.

Standing subcommittees would act with power to approve and monitor the success of content and pedagogy changes in the associated requirements. Changes significant enough to warrant a new subject description or the creation of a new flavor or format of a particular requirement would be approved by the subcommittee as well as CoC.

Ad Hoc Subcommittee on the SMC Requirements

The ad hoc subcommittee would be charged with:

- Working with relevant departments to define learning outcomes for each SMC GIR at the 6-unit (for the flexible foundations) and 12-unit (for the common foundations) levels.
- Developing written criteria and a process for certifying subjects for SMC GIR credit. New SMC subjects should be challenging but not impossible to create, and the SMC committee will have to set the criteria accordingly. Additionally, in considering whether to allow a new subject proposal, the SMC committee would consult disciplinary committees (e.g., disciplinary Undergraduate Education Committees in the case of science and Mathematics subjects; The Common Ground in the case of a new computing subject).
- Recommending existing, revised, and newly created SMC subjects for approval by CoC.
- Working with the Vice Chancellor for Graduate and Undergraduate Education to incentivize and facilitate the creation of integrated GIR subjects as defined by TFUAP.
- Determining whether and how AP/IB and ASE credit can be used to satisfy the SMC GIRs.
- Coordinating with the PSM requirement subcommittee as appropriate.

Membership would include representatives from units teaching the SMC GIRs and representatives from each of the schools, including:

- Faculty chair
- Representatives from disciplines: Undergraduate Officers from Biology, Chemistry, Mathematics, Materials Science, and Physics (or their designees); co-chair of the Common Ground (or their designee)
- The chair of the Ad Hoc Subcommittee on the PSM requirement
- 1 additional representative from each school and the college

- 2 undergraduate students
- Staff to the committee (non-voting)

Ad Hoc Subcommittee on the PSM Requirement

The ad hoc subcommittee would be charged with:

- Working with relevant departments to define learning outcomes for the PSM requirement.
- Developing written criteria for approving new PSM subjects.
- Recommending existing, revised, and newly created PSM subjects for approval by CoC.
- Coordinating with the SMC requirements subcommittee as appropriate.

Given that probability, statistics, and machine learning are taught in several departments across most, if not all, schools at MIT, this subcommittee is distinct in kind from the rest of the SMC requirements, necessitating specific representation from individuals who can speak to the different disciplinary approaches to these topics, including:

- Faculty chair
- 1 Faculty representative from each of the five schools and the college
- 2 undergraduate students
- Staff to the committee (non-voting)

Ad Hoc Subcommittee on the Teamwork-Intensive Requirement

The ad hoc subcommittee would be charged with:

- Working with experts on teaching teamwork and reviewing relevant literature to define a set of learning outcomes for all TI subjects.
- Developing written criteria for approving new TI subjects.
- Coordinating with departments to adapt existing subjects and create new subjects focused on teamwork.
- Recommending existing, revised, and newly created TI subjects for approval by CoC.

Given that teamwork is expected to be primarily taught within majors, this subcommittee should include representatives who can speak to the different disciplinary approaches to teaching teamwork, including:

- Faculty chair
- 1 Faculty representative from each of the five schools
- 2 undergraduate students
- Staff to the committee (non-voting)

Additionally, TFUAP recommends the creation of a Mens et Manus Scholars Committee (MMSC), administered by the Office of Experiential Learning, to oversee admission to the Mens et Manus Scholars.

New Task Forces

Task Force on Grading

Rationale

Over the past decade, grading has been a central focus of many CUP discussions, leading to the creation and continued monitoring of the current Flexible P/NR policy. Likewise, national conversations concerning patterns of "grade inflation" have prompted study of MIT's own patterns of grade distributions. What is clear is that there has been what we call "grade compression," whereby grades are less distributed across the spectrum and instead concentrate in the A and B ranges. However, we have not seen evidence that standards are falling, and a variety of credible hypotheses for why grade compression has occurred have been proposed. Such hypotheses include those, such as more selective admissions and more effective teaching, that would suggest that the grades accurately measure improved average performance.

Regardless of the causes, however, grade compression has downsides, including the challenges of identifying excellence among students and the perception of many students that anything less than an A should be considered failure.

After discussing the topic of grading on several occasions, TFUAP concluded that the topic demanded more time and attention than we could feasibly provide, given our other goals. Therefore, we recommend that a task force be created to study and propose new policies and practices on grading.

Format and Objectives

While faculty governance should determine the exact format, charge, and timeline for the task force, we recommend that membership include faculty from all Schools and the College, student representatives, and at least one staff member from the Teaching and Learning Lab with expertise on the latest research around grading.

The task force should consider the following questions:

1. How do internal and external stakeholders, including students, faculty, employers, and graduate schools, interpret MIT's current grades?
2. How does the grading system impact student behavior in their classes?
3. What new policies might motivate students and reward beneficial learning behaviors while reducing stress?
4. What new policies might reward and distinguish "excellence" without compromising MIT's collaborative (rather than competitive) student culture?

Any proposed policies should be considered for their impacts on our students' ability to get into top-tier graduate schools, including medical schools, as well as their impacts on student stress, motivation, and learning behaviors. Proposals may include both institute-wide policies (such as first-semester P/NR) and support for subject-based approaches that instructors could choose to adopt if they wished (such as specifications grading).

Task Force on AI in Teaching and Learning

The role of artificial intelligence generally and large language models (LLMs) in particular has evolved rapidly over the past two years as TFUAP has met. Earlier drafts of this report outlined a proposal to create a new Task Force on AI in Teaching and Learning, and we are delighted to see that faculty governance and the Provost's and Chancellor's Offices have created an ad hoc committee with a charge that reflects most of what we planned to recommend. TFUAP endorses this new committee and looks forward to the results of their work.

The work of this ad hoc committee, which is presently scheduled to conclude in Spring 2025, will be a first step toward addressing the implications of AI for MIT education. We recommend it be followed up on by a Task Force on AI in Teaching and Learning to address these issues over a longer-term horizon. Specifically, we note that the response to AI in communications-intensive classes is an ongoing area of study for SOCR, and we recommend that SOCR be involved in any ongoing discussions.

New Responsibilities for Existing (Sub)committees

Committee on the Undergraduate Program (CUP)

As part of its oversight of the undergraduate program, TFUAP recommends that the CUP write a report to the faculty every five years on the state of the program. The report should address:

1. The overall state of the undergraduate program and trends in departmental programs.
2. A review of the GIRs.
3. Opportunities for positive changes in the program as a whole, the GIRs, or pedagogy.
4. An overview of any areas of concern.

Committee on Curricula (CoC)

In addition to their existing tasks, TFUAP recommends that the CoC conduct a semesterly audit of hours spent on classes to ensure that the expected workload aligns with the subject units. For example, CoC may decide that any subject where the reported hours on student subject evaluations differed by more than 40% of the listed units would be flagged for review (e.g., a 12-unit class where the average reported hours were <7.2 or >16.8). The CoC would then choose to issue a notice to the instructor (recommended for first-time offenses or low response rates) or provide notice to the department that unless the subject is recalibrated in the subsequent semester, the units listed would need to be changed.

Subcommittee on the Communications Requirement (SOCR)

As part of their regular duties, TFUAP recommends that SOCR oversee limited experiments in CI subjects and recommend changes to the CI guidelines as outlined in the CI section above. They would be expected to report to CUP as usual and collaborate with other committees, including the Task Force on AI in Teaching and Learning, as appropriate.

Subcommittee on the HASS Requirement (SHR)

TFUAP recommends that SHR develop and implement a process for certifying subjects that meet the Moral and Civic Perspectives (MCP) requirement as outlined in the HASS section above. As an ongoing part of their regular duties, SHR will certify new MCP subjects, periodically review existing subjects, and assess the overall effectiveness of the requirement. Assessment findings should be reported to CUP.

6: Flexible Curriculum Experiment

Throughout our process, TFUAP has noted substantial interest from various members of the institute to decrease requirements and add flexibility. While TFUAP's design adds some flexibility, we believe it may be feasible and even beneficial to go further, and we note that many other schools have more flexible requirements than MIT's without compromising on educational quality. Perhaps more critically, we believe it is important for MIT to obtain data on what students do when provided with more flexibility, to inform the next task force or group charged with examining the undergraduate program.

To explore this possibility, we propose that CUP design and authorize a limited experiment that would allow up to 100 students per year to opt out of a small number of requirements. The goal with this experiment would be to learn what would happen if the GIRs were cut roughly in half. The experiment could be structured as follows:

1. Newly admitted students would apply to join the experiment, and up to 100 would be drawn from applicants to be representative of the overall student body in terms of demographics and intended fields of study. The experiment would be available for three consecutive classes.
2. Students in the experimental group would:
    a. Complete any 36 units of the SMC GIRs
    b. Complete any 4 of the 8 HASS GIRs
    c. Complete all other requirements as outlined above
    d. Complete 1 fewer restricted elective in their major (note: this may not apply to ABET-accredited majors)
3. A study team would assess the impacts by comparing the experimental group to a control group of students who applied but were not accepted into the experiment.

    a. Measures would include tracking which GIRs students take, which courses they major in, their grades, and performance measures like fifth-week flags and CAP actions.
    b. Additional outcomes tracked would include participation in UROPs and other experiential learning, application and admission to graduate school, and first jobs after graduation.
    c. Outcome data would be supplemented by surveys of students in the experiment and control groups.
4. After 7 years (allowing most members of the three experimental cohorts to graduate), the study team would report on the outcomes to the CUP and Faculty. The CUP would recommend next steps, which may include broader implementation of flexibility, affirmation of existing approaches, and further experiments with even more flexibility.

7: The current and future role of AI in UG education

It is nearly impossible to discuss education in 2025 without discussing AI generally and generative AI in particular, given the profound impact it has had in the past few years on both what and how students learn. AI has come up in many TFUAP discussions, both internally and with MIT community members, and the consensus within TFUAP has consistently been that whatever we propose must be flexible and resilient enough to adapt to the dramatic changes that are likely ahead.

Our approach to AI is best described through the advance, align, and adapt framework that TFUAP has adopted to describe our overall set of recommendations. The new computing and probability, statistics, and machine learning requirements will advance the curriculum to ensure that all students understand the technical fundamentals underpinning the development of AI, and we expect that both requirements will evolve to both utilize and explain cutting-edge AI technology. Our approach to the HASS and CI requirements aligns MIT's curriculum with the learning goals TFUAP feels will be more important than ever in the AI age, such as critical reading, effective communication, and a moral, ethical, and civic framework. Furthermore, we have challenged SOCR to experiment and ensure that the methods of communication our students learn are those that will remain relevant. And finally, knowing that we cannot predict the future of AI, we have proposed a governance body that will help MIT's educational apparatus adapt to the changes ahead: a Task Force on Artificial Intelligence in Teaching and Learning. We expect that this task force will also help advance our curriculum and pedagogy to meet the current moment and align our AI policies with the institute's goals and values, but their most important role will be to act as a nimble body to help MIT approach the challenges and opportunities of AI with wisdom and curiosity.

8: Conclusion

After two years of listening, learning, and discussing what it does and should mean to get an undergraduate education at MIT, we believe that we have proposed a curriculum and set of policies, programs, and committees that will serve our students well. In everything we proposed, we sought to balance a need to maintain the qualities of challenge, collaboration, and creativity that have long characterized an MIT education with the reality that students and faculty alike have a finite amount of time and energy to dedicate to their many worthwhile academic pursuits. This is not a new goal, and we hope that future faculty and administrators will continue to recalibrate to meet changing student needs.

On the whole, we are optimistic about the work ahead. The policies we proposed would ease stress and create opportunities for deeper engagement in residential learning. The governance structures and experiment would enable ongoing iteration and collaboration to ensure that the undergraduate program remains current. And the curriculum we proposed would create more well-rounded students with a broader disciplinary toolkit to draw upon and a more nuanced understanding of the world around them. Implementing this new vision for undergraduate education will be challenging and will draw on the expertise of faculty, staff, and students from across campus. But if there is one thing we know about the MIT community, it is that we are not afraid of a challenge.

Appendices

A. TFUAP Charge and Membership
B. TFUAP Goals
C. Implementation Timeline
D. Supporting Data Regarding Scheduling Policies
E. References and Supporting Materials for Pedagogy Section
F. Analysis of Possible Impacts on Existing Major Requirements

Appendix A: TFUAP Charge and Membership

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[9] (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.[10] Informed by these 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.

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[9] 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.

[10] 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 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.

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, ‘25, Course 20 & Course 24-1
Rob Miller, School of Engineering & Schwarzman College of Computing
Bill Minicozzi, School of Science, CUP
Caitlin Ogoe, ‘25, 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

Appendix B: TFUAP Goals

For a full explanation of these goals and how they were developed, please see the TFUAP Phase 1 Report.

Learning Goals

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.

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

3. Every MIT graduate will be able to critically analyze their values and their responsibility to other people and the planet, and articulate reasons for their choices. They will understand relationships between individuals and society. Graduates will also know how to gather evidence from, interpret, and make arguments about events, texts, and artistic production from the past and present.

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

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

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.

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.

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.

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

10. Every MIT graduate will be empowered to dream big. They will have the capacity to draw on their creativity to imagine, design, or build transformative future worlds that better serve humankind.

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 and physical making/breaking
4. Celebrate unique passions, creativity, joy of learning, and sense of wonder

5. Provide meaningful mentoring relationships

Appendix C: Implementation Timeline

We provide a possible timeline for implementing the recommendations proposed in this report. As our ability to predict the future is limited, this timeline is intended to help guide but not dictate. Like all complicated projects, it will need to be revised over time.

Many of our recommendations ultimately require a vote of the MIT Faculty. This includes any changes to MIT's Rules and Regulations, including changes to GIRs, academic calendar, and registration. We are hopeful that these votes can occur in the 2026-27 academic year.

Curricular changes

Common Foundations. It will take 1-2 semesters to revise 18.02, which is the only subject with substantial initial revision in this list. Changes to the Physics GIR will be gradual and ongoing, though they may still require central MIT resources.

Flexible Foundations. The *ad-hoc* committees will take 12-18 months to be set up, develop their specifications, and work with departments and instructors to develop an initial set of subjects for the flexible foundations. Some subjects already exist (3.091, 5.11, 7.01x, etc.), but other subjects will need to be developed, including integrated offerings and some 6-unit offerings.

Teamwork-intensive Requirement. The *ad-hoc* committee will take 12-18 months to be set up, develop their specification, and work with departments and instructors to develop an initial set of subjects for this requirement.

CI Requirement. Changes to this requirement will take approximately 5 years, as described in detail in Section 2C.

Moral and Civic Perspectives Requirement. SHR will require 1-2 semesters to finalize the certification process and work with departments and instructors to develop an initial set of subjects for this requirement.

PE + Wellness Requirement. Changes to this requirement can become effective the next academic year following a vote, though new course offerings can take additional time to develop.

Experiential Learning. The Mens et Manus Scholars will take ~1 academic year to formulate and set up. Faculty-mentored UROPs can be implemented immediately.

Altogether, we anticipate that curricular changes can become effective for either the entering class of 2028 or 2029.

Policy changes

Clarity

Abolish the guidelines limiting overlaps between majors and GIRs. This can be incorporated immediately after a faculty vote.

Require that syllabi be posted publicly (or at least visible to all MIT users). This should be piloted with a subset of departments and then rolled out more broadly, taking 2-3 semesters.

Require interim grade reports one week before drop date. This should be piloted with a subset of departments and then rolled out more broadly, taking 2-3 semesters.

Commitment

Eliminate pre-registration and move registration to the second half of the prior semester. This should take around 1 academic year after a vote.

Shift Add Date and Drop Date earlier (to Week 4 and Week 9, respectively). This should take around 1 academic year after a vote.

Reduce scheduling conflicts and ban double-booking. This will take 3-4 academic years to fully implement and take effect. Full enforcement of a double-booking ban will require a new registration system to be in place, which is expected in the next several years.

Reset classroom expectations. This can be implemented the semester following discussion at an Institute Faculty Meeting.

Compassion

Add a class day on the current fall Registration Day and remove a class day on the Wednesday before Thanksgiving . This can be incorporated one or two academic years after a vote, depending on how far ahead the academic calendar must be finalized.

Prohibit instructors from setting assignment due dates on holidays, the day before or after Thanksgiving break, or the day after spring break. This can be incorporated the semester after a faculty vote.

Shift the "last test date" earlier in the spring semester to better align with the fall. This can be incorporated the semester after a faculty vote.

Changes to subjects and courses

We anticipate that many degree programs will make modest changes to their subjects and program structure in response to TFUAP's recommendations. Some departments may want to make changes immediately, and others may want to wait until particular curricular and policy changes are fully implemented. In either case, CoC will see an influx of minor or major changes to courses over 3-4 years. We strongly encourage the CoC to work proactively with departments so that changes can occur as quickly as possible.

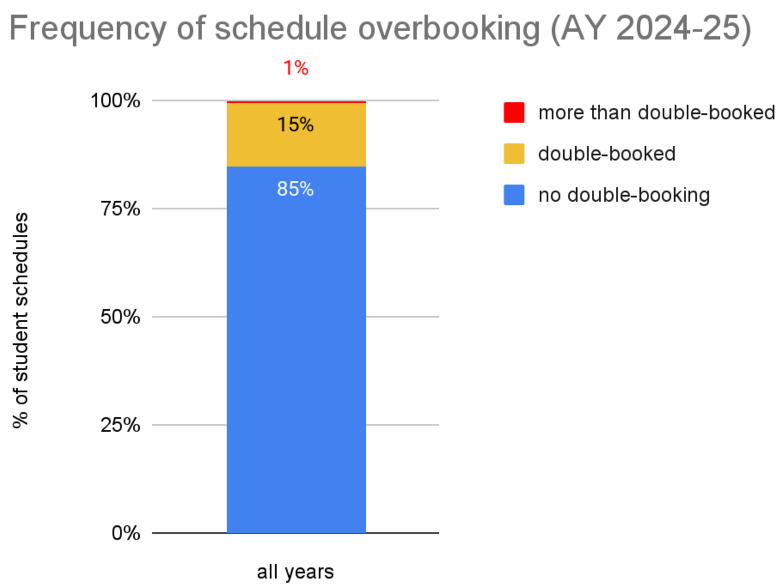
Pedagogy

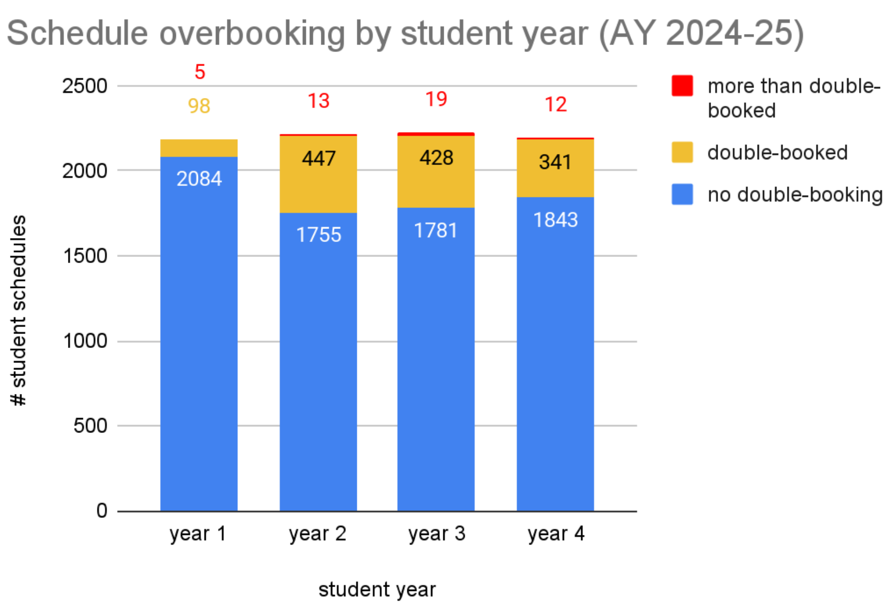
The sub-initiatives within pedagogy (CADI, SSTs, ISCoP) should be created alongside and with the same timeline as the commensurate curricular changes.

Flexible Curriculum Experiment

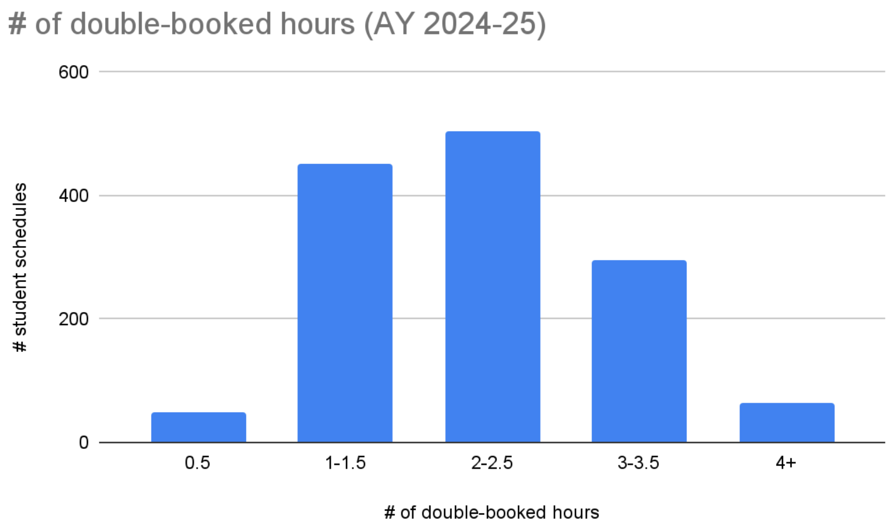
The timing of this experiment will be dictated by CUP.

Appendix D: Supporting Data Regarding Scheduling Policies

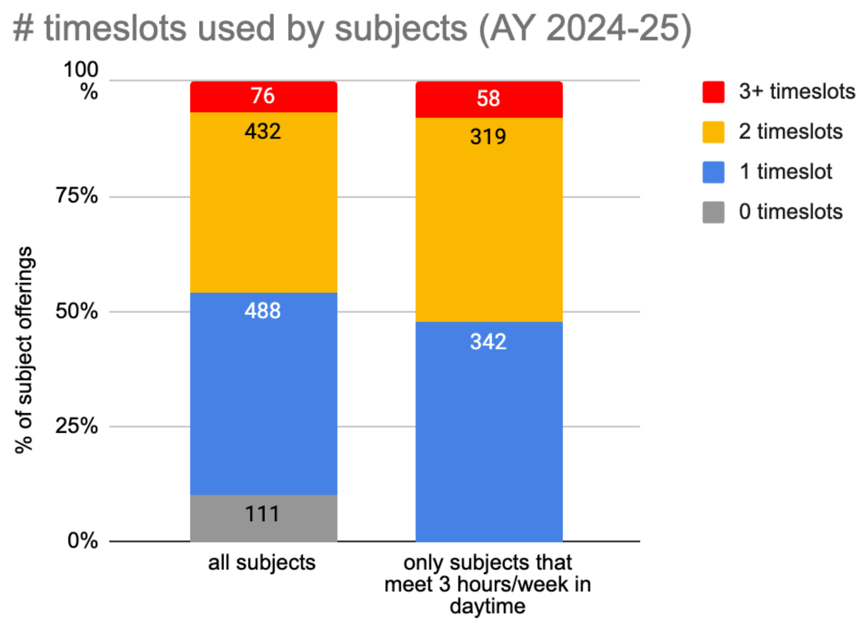


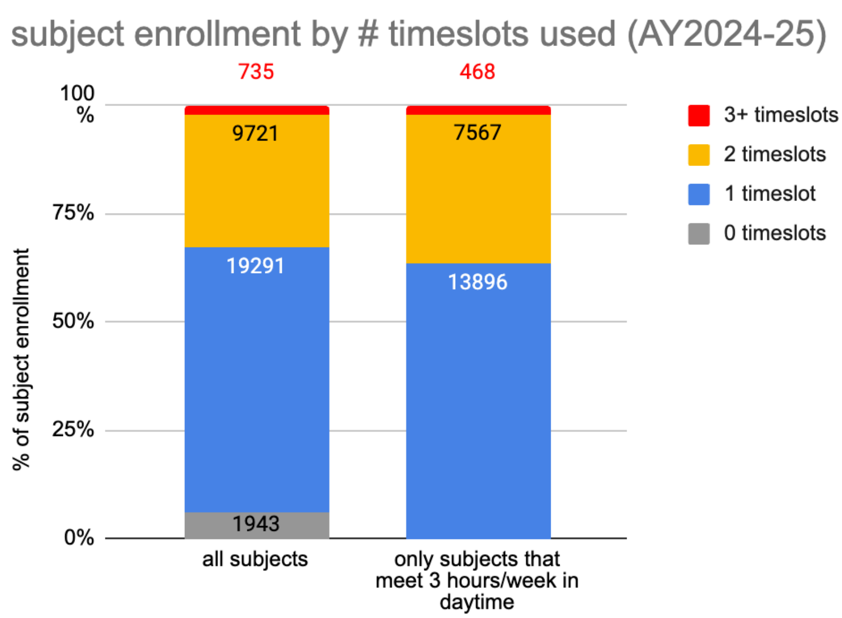


Frequency of overbooked schedules. "Double-booked" means that two of the subjects on the student's schedule have main lecture periods that overlap in time; "more than double-booked" means three or more subjects overlap. Data shows student schedules from fall 2024 and spring 2025, only undergraduate subjects with one lecture section where the student was registered for credit after Add Date. A typical student will have two schedules in this data, one for the fall semester and one for spring.



Number of hours double- or triple-booked. "Double-booked" means that at least two of the subjects on the student's schedule have main lecture periods that overlap in time. Data shows only double-booked student schedules from fall 2024 and spring 2025 (Course 6 majors or double-majors only). A student may have two schedules in this data, one for the fall semester and one for spring.





How timeslots are used by subjects. One "timeslot" in this analysis is one of the daytime meeting schedules recommended by the Registrar: MWF for one hour starting on the hour, or TR for 1.5 hours starting at 9:30, 11, 1, or 2:30. A subject uses 1 timeslot if its main lecture section fits entirely into one of those recommended meeting schedules; 2 timeslots if its lecture section overlaps two of those schedules. Evening subjects use 0 timeslots. Top graph shows number of offerings during the academic year (fall and spring count as separate offerings); bottom graph shows total enrollment in those offerings. The 2 and 3+ sections of the rightmost bars show that more than 50% of 3-hour-per-week lecture subjects are using nonstandard timeslots, overlapping more than one standard timeslot, and affecting 37% of the students enrolled in 3-hour-per-week lecture subjects.

Appendix E: References and Supporting Materials for Pedagogy Section

TFUAP White Papers Leveraged for this section

- Barnes: Optimizing the MIT Educational Experience Through Learning Science, Technology, and Collaboration
- Soicher: Pedagogical Professional Development for GIR Instructors
- Tomasik: A Community Approach to the Science-Core GIRs for Improved Coordination, Learning, and Assessment

Science of learning

- Applying the science of learning to the university and beyond: teaching for long-term retention and transfer D.F. Halpern, M.D. Hakel **2003** Change v35 no4 p36-42
- Deans for Impact (2015). *The Science of Learning*. Austin, TX: Deans for Impact
- Transfer as the goal of education, Authentic Education, Grant Wiggis, 2010
- Applying the Science of Learning/Research-Based Teaching Initiatives at other institutions
  - Cornell's Active Learning Initiative has transformed undergraduate courses by supporting
  - Purdue's leadership in Engineering Education has set a benchmark for integrating research-backed teaching to enhance the learning experience.
  - UMich Foundational Course Initiative

Interdisciplinarity

- Designing Interdisciplinary Courses William H. Newell defines interdisciplinary teaching as including 2 or more disciplines
- Defining and Teaching Interdisciplinary Studies William H. Newell and William J. Green, *Improving College and University Teaching*, Winter, 1982, Vol. 30, No. 1 (Winter, 1982), pp. 23-30. Published by: Taylor & Francis, Ltd. Stable URL: https://www.jstor.org/stable/27565474

  See the description of "Energy: A Combined Physical and Social Science Approach" on p. 27 (disciplines include chemistry, biology, economics, and political science):

  > *"...the Western [University] faculty have offered seminars in American Environmental History,the World Food Problem, Cubism and Relativity, Darwinian*

Influences on Nineteenth- and Twentieth Century Thought, and Creativity and Imagination in the Physical Sciences - all of which have required students to master technical subject matter in chemistry, physics, biology and geology."

See also the section on Educational Outcomes on p.29

- Interdisciplinary Curriculum Development William H. Newell *Issues in Integrative Studies*, No. 8, pp. 69-86 (1990). See, in particular, page 79, wherein Newell discusses the importance of early exposure to interdisciplinary ways of thinking:

  > *"Sequencing. Interdisciplinary courses represent a significant departure from the course structure and style of teaching and learning to which students are typically exposed in high school. They are most likely to accept the unfamiliar roles of faculty and students and the structure of an interdisciplinary course, and embrace its active, critically questioning style of learning, if they are exposed to it in the first semester of their first year in college, when studies indicate that the significant changes normally take place in college students. It is true that the relativistic thinking required in an interdisciplinary course may clash with the concrete thinking of some entering students [10], but interdisciplinary courses are an effective vehicle for moving students through Perry's stages (because they demonstrate the inadequacy of concrete thinking and the necessity of relativistic thinking and commitment), and the first semester of the first year is the time in college when they are most open to new thinking styles. Thus there are important advantages in introducing students to an interdisciplinary curriculum their first semester in college. Since interdisciplinary study builds directly on the disciplines while offering a holistic counterbalance to the reductionist perspectives they afford, a curriculum that intersperses disciplinary and interdisciplinary courses allows each to build on the strengths of the other, For example, after taking intermediate theory courses in economics, sociology, and political science, students might take interdisciplinary topical courses drawing on those analytical tools; e.g., an interdisciplinary course on modernization (replacing currently offered courses on political modernization, economic development, and the sociology of modernization). With the assistance of interdisciplinary courses, students can place in perspective the disciplinary tools they are acquiring, keeping sight of their limitations as well as their strengths, and assessing their relative contributions to complex issues.*

- Bio2010: Transforming Undergraduate Education for Future Research Biologists National Research Council (US) Committee on Undergraduate Biology Education to Prepare Research Scientists for the 21st Century. Washington (DC): National Academies Press (US); 200 (see examples & case studies in Section 3 - includes many examples (at various scales) from Bio + X courses.
- General Bio example: Tripp, B., Shortlidge, E.E. A Framework to Guide Undergraduate Education in Interdisciplinary Science. *CBE—Life Sciences Education*, Vol. 18, No. 2, 23 May 2019. https://doi.org/10.1187/cbe.18-11-0226 (Scroll down to sections: IDSF curricular Example and Implications for Core Competencies. The latter is particularly interesting because it highlights the ways that the interdisciplinary course can support the development of core competencies in Biology.)

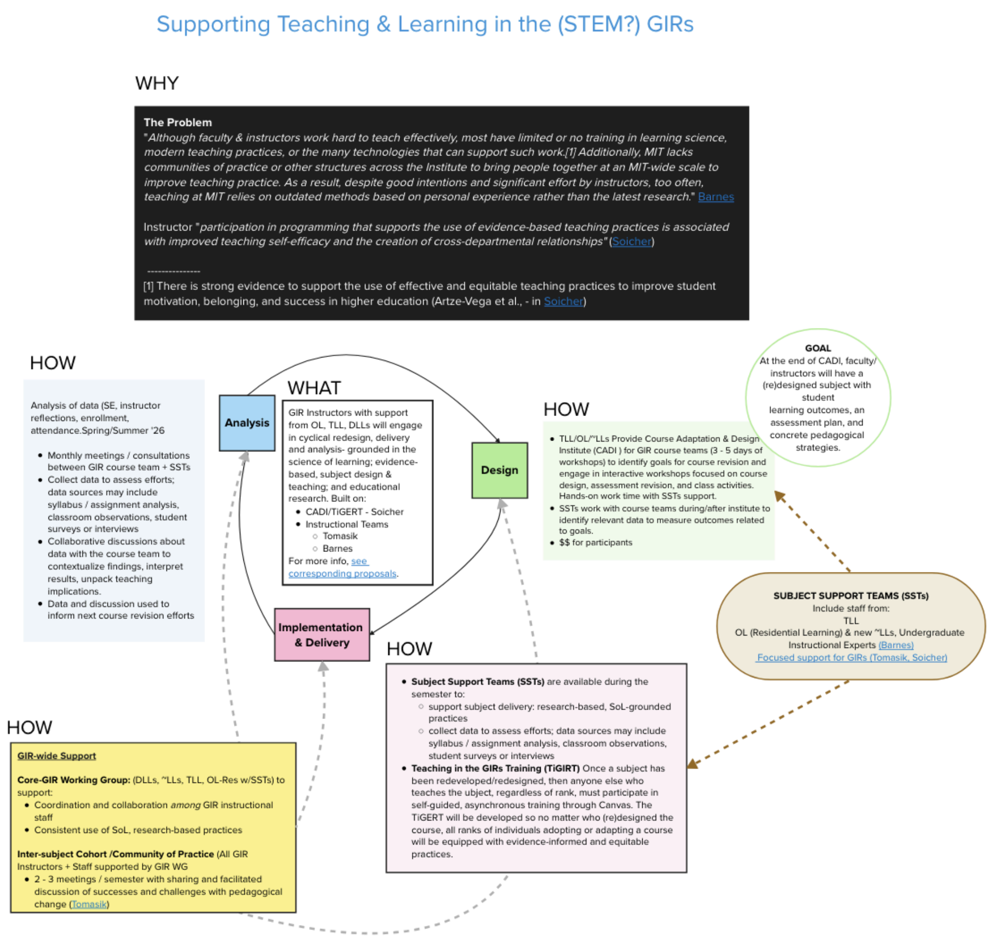
Examples from MIT

- [21.01 (Compass Course: Love, Death, and Taxes: How to Think — and Talk to Others — About Being Human)]
- [Vision in Art and Neuroscience] (9.72) Pawan Sinha, Seth Riskin, Sarah Schwettmann
- Graham Jones & Seth Riskin [Paranormal Machines: Technologies of Enchantment in Science, Art, and Culture] (21A.S01)

Example from Other Institutions

- Duke: [BIOL 203 Molecular, Behavioral and Social Evolution: Evolution of Genomes, Traits, Behaviors, and Societies] (scroll down to the header: BIOL 203: An example)
- Dartmouth: Korey, J. (2002, July). [Successful interdisciplinary teaching: Making one plus one equal one]. In *2nd International conference on the teaching of mathematics at the undergraduate level Hersonissos, Crete.*

Diagram illustrating connections between the proposed pedagogical programs



Click thumbnail for link to full framework

Appendix F: Analysis of Possible Impacts on Existing Major Requirements

TFUAP is proposing a wide set of changes, and a central question will be the impact on existing courses of study, many of which rely on existing GIRs and their structure. It is important to TFUAP that existing courses are strengthened by these recommendations, supporting learning goal 7. No major will be forced to decrease in size due to our recommendations. That said, the GIRs provide foundational knowledge for the majors, and as the GIRs change, the majors must also adapt; we have thus assumed modest "like-for-like" adaptation in our analysis below. The ultimate decisions will, of course, lie with departments, but we include the following analysis to explore possible approaches to reworking requirements in a subset of the majors that require the most units to complete and that rely on the SMC GIRs as prerequisites.

In our current system, majors have a maximum of 12.5 subjects and can specify up to 36 units of GIRs from the REST and Institute Lab subjects, allowing at most 15.5 subjects. In our recommendations, we propose to allow majors (courses) to increase from a maximum of 12.5 subjects to 14.5 subjects, reflecting in part the removal of the REST and Institute Lab requirements. We further recommend that majors be allowed to specify 12 units of GIR subjects (such as the Teamwork Intensive or Probability, Statistics, and Machine Learning subject), allowing up to 15.5 subjects for majors that do so.

Below we provide an analysis of selected majors, demonstrating approaches for all of them to fit within the revised guidelines, and sometimes even freeing up units.

SB in Engineering as recommended by Civil and Environmental Engineering (1-ENG)

- Current
    - 168 units in major, including 36 units via REST & Institute Lab
    - Requires 5.111/3.091 (for 3.010)
- Potential adjustment
    - Computing: New computing GIR would substitute for 1.000 [12 units removed]
    - Teamwork Intensive: 1.013 + 1.101 [existing, 12 units O/L]
    - Opportunities exist for adjusting 1.010A/1.073/1.074 to fit within the PSM requirement
- Net impact: (168) + (-12 changed) = 156 units (13 subjects, including 12 units overlap via TI subject)

Mechanical Engineering (2)

- Current
    - 177-180 units in major, including 36 units via REST & Institute Lab
    - Requires 8.01 (for 2.001), 8.02 (for 2.003, 2.004, 2.005), and 5.111/3.091 (for 2.002)
- Potential adjustment

    - Physics: the 2.00x series would build on the physics GIR and 8.02 [12 units added]
    - Computing: Either 2.086 certified/revised to meet computing GIR or revise course to use new computing GIR [12 units removed]
    - Integrated Chemistry/Biology: New GIR class substitutes for 5.111/3.091 or major requires 12 units of Chemistry [no units change]
    - Teamwork Intensive: 2.009, 2.013 2.750J, or 2.760 [existing, 12 units O/L]
- Net impact: (177-180) + 0 units = 177-180 units (14.75-15 subjects, including 12 units overlap via TI subject)

Materials Science and Engineering (3)

- Current
    - 168-174 units in major, including 36 units via REST & Institute Lab
    - Requires 5.111/3.091 (for 3.010)
- Potential adjustment
    - Computing: New computing GIR would substitute for 6.100A [6 units removed]
    - Integrated Chemistry/Biology: New GIR class substitutes for 5.111/3.091 or require full 5.111/3.091 [0-6 units added]
    - Teamwork Intensive: 3.042 [existing, 12 units O/L]
    - Opportunities exist for adjusting 18.03/18.06/18.C06 requirement and/or 3.029 requirement
- Net impact: (168-174) + (-6 to 0 changed) = 162-174 units (13.5-14.5 subjects including 12 units overlap via TI subject)

Electrical Engineering with Computing (6-5)

- Current
    - 174-186 units in major, including 36 units via REST & Institute Lab
    - Requires 8.02 (for 6.200)
- Potential adjustment
    - Physics: 6.200 would depend on 8.02 [12 units added]
    - Computing: 6.100 would substitute for 6.100A [6 units removed]
    - Linear Algebra removed due to inclusion in 18.02 [12 units removed]
    - Teamwork Intensive: 6.900 [existing, 12 units O/L]
- Net impact: (174-186) + (-6 changed) = 168 - 180 units (14-15 subjects including 12 units overlap via TI subject)

Chemical Engineering (10)

- Current
    - 174-183 units in major, including 36 units via REST + Institute Lab
    - Requires 8.01 (for 10.10), 7.01 (for 7.03), 3.091/5.111 (for 5.12 & 10.10)
- Potential adjustment
    - Physics: 10.10 builds on physics GIR [no units change]

    - Chemistry : Full 12-unit version required [no units change]
    - Teamwork Intensive: 10.26, 10.27, 10.28, 10.29, or 10.467 [existing, 12 units O/L]
- Net impact: 174-183 units = (14.5-15.25 subjects including 12 units O/L) [no change]

Chemical-Biological Engineering (10-B)

- Current
    - 180 units in major, including 36 units via REST + Institute Lab
    - Requires 8.01 (for 10.10), 7.01 (for 7.03), 3.091/5.111 (for 5.12 & 10.10)
- Potential adjustment
    - Physics: 10.10 builds on physics GIR [no units change]
    - Major would require 12 units of Chemistry and 12 units of Biology [no change]
    - Teamwork Intensive: 10.27, 10.28, or 10.29 [existing, 12 units O/L]
- Net impact: 180 units = (15 subjects including 12 units O/L) [no change]

Aerospace Engineering (16)

- Current
    - 180-186 units in major, including 36 units via REST + Institute Lab
    - Requires 8.01 (for 16.001), 8.02 (for 16.002, 16.003, 16.004)
- Potential adjustment
    - Physics: 16.00x series builds on physics GIR and 8.02 required [12 units added]
    - Computing: New computing GIR would substitute for 6.100A/(6.100B or 16.C20) requirement [12 units removed]
    - Teamwork Intensive: via one "Laboratory & Capstone" subject [existing, 12 units O/L]
- Net impact: (180-186) units (15-15.5 classes including 12 units O/L) [no change]

Biological Engineering (20)

- Current
    - 180-183 units in major, including 36 units via REST + Institute Lab
    - Requires 7.01 (for 7.03), 8.01/8.02 (for 20.110), 3.091/5.111 (for 5.12)
- Potential adjustment
    - Physics: 20.110 builds on physics GIR [no units change]
    - Computing: New 6-unit computing GIR would substitute for 6.100A requirement [6 units removed]
    - Major would require 12 units of Chemistry and 12 units of Biology [no change]
    - Teamwork Intensive: no existing class, but 20.309 could be adjusted [12 units overlap]
- Net impact: (180-183) units + (-6 units changed) = 174 - 177 units (14.5-14.75 classes including 12 units O/L)

Nuclear Science and Engineering (22)

- Current
  - 186 units in major, including 36 units via REST + Institute Lab and 12 units via HASS
  - Requires 8.02 (for 2.005)
- Potential adjustment
  - Physics: require 8.02 because 2.005 builds on it [12 units added]
  - Computing: New computing GIR would substitute for 6.1000 [12 units removed]
  - Teamwork Intensive: via 22.033 [existing, 12 units O/L]
  - Opportunities exist for Mathematics Elective to utilize PSM instead
- Net impact: (186) units + (0 units changed) = 186 units (15.5 classes including 12 units O/L + 12 units HASS)

Computer Science and Molecular Biology (6-7)

- Current
  - 180-186 units in major, including 36 units via REST + Institute Lab
  - Requires 7.01 (for 7.03), 3.091/5.111 (for 5.12)
- Potential adjustment
  - Computing: New 6-unit computing GIR would substitute for 6.100A requirement [6 units removed]
  - Major would require 12 units of Chemistry and 12 units of Biology [no change]
  - Probability, Statistics, and Machine Learning: 6.C01/7.C01 [12 units overlap]
- Net impact: (180-186 units) + (-6 units changed) = 174-180 units (14.5 - 15 classes, including 12 units overlap)

Physics (8)

- Current
  - 174 units in major, including 36 units via REST + Institute Lab
  - Requires 8.01&8.02 (for 8.03), 8.02 (for 8.033)
- Potential adjustment
  - Physics: New GIR class substitutes for 8.01, 8.02 still taken [12 units added]
  - Teamwork Intensive: no existing class, 8.13 or 8.14 could be adjusted to include teamwork [12 units overlap]
- Net impact: 174 units + (+12 units added) = 186 units (15.5 classes including 12 units overlap)

Chemistry and Biology (5-7)

- Current
  - 154-157 units in major, including 36 units via REST + Institute Lab
  - Requires 8.01 (for 7.03), 3.091/5.111 (for 5.12), 7.01 (for 7.03)
- Potential adjustment

    - Major would require 12 units of Chemistry and 12 units of Biology [no change]
- Net impact: (154-157) units = (12.8 - 13.1 classes) [no change]