INTERIM REPORT FALL 2019:

AN EXPERIMENT TO EVALUATE OPTIONS FOR PROMOTING EXPLORATION IN THE FIRST-YEAR UNDERGRADUATE EXPERIENCE

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SUMMARY

This document is an interim report on Phase One of the curricular experiment currently in progress with students who entered MIT in fall 2018. Phase One applies to students who entered in fall 2018 (nominally the Class of 2022). The experiment was designed to evaluate options for enabling greater exploration of fields and majors during the first-year. These options are being evaluated with respect to objective and subjective measures of students' experiences, academic progress, and health and well-being. The primary objective measures are grades and registration behavior, while subjective measures are drawn from surveys and interviews. These measures from the experimental cohorts have been and will continue to be compared to those of the class who entered in 2017 (nominally the Class of 2021), which serves as the control group.

This report details interim data collected on Phase One of the experiment. The data includes student choices and behaviors during their first year, but many of the downstream impacts remain to be seen. Interim data was used to inform the Phase Two experimental policy which applies to students who entered in fall 2019, but Phase Two will not be discussed in this report.

Phase One allows the treated cohort to designate up to three science core GIRs as Pass/No Record (P/NR) after their first semester at MIT. (The first semester was still be graded P/NR, and the second semester ABC/NR).

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PHASE ONE STRUCTURE AND INTENTIONS

WHY THIS? WHY NOW?

Concerns about the first year at MIT are not new. The Lewis Committee created a predecessor to the CUP in part to address the very same issues that this experiment seeks to inform.

> "One of the most damaging criticisms of our undergraduate program is that the students feel so harassed by rigid routine and so overburdened by the quantity of work required in the individual subjects that they do not have time for reflective thinking or for the social experience that should be an important part of a college education. We recognize this unrelieved tension as a serious evil and we think that steps should be taken to remedy it."
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> "We think it particularly serious in the freshman year."
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> (Committee on the Educational Survey, Lewis et al., 1949.)

These and many other issues mentioned in the Lewis Committee report remain concerns at MIT today, as highlighted by these quotes from students describing why they wanted to participate in the "Designing the First-Year at MIT" class in 2018:

> "For me it felt like there was no choice freshman year. I felt like I was moving along a conveyor belt and I had no control."
>
> "I went to MIT undergrad and had an experience that made me believe I didn't enjoy learning anymore."
>
> "MIT is not giving its freshman a proper sense of direction."
>
> "I took all the GIRs and then didn't start my major until sophomore year. I didn't really love it but felt stuck in it because of scheduling and was afraid I'd be a year or semester behind all of my friends."

More than 100 students, faculty, and staff participated in the class, and many hundreds more at MIT provided input and were engaged in discussions with the students. At the Faculty Curriculum Workshop on June 14, 2018—attended by approximately 100 faculty, staff and students—many participants echoed the importance of addressing the needs in the first-year and spoke in favor of a both a deep reconsideration of the GIRs and pursuing significant educational experiments.

The need for major exploration in the first-year was also underscored in the 2018 Perceptions of Academic Majors Survey released in June 2018. When asked whether they agree or disagree with the statement "I am/was well-prepared to choose my major," only 33% of respondents strongly agreed, 40% agreed somewhat, and the remaining twenty-seven percent either felt neutral or disagreed with the statement. Thirty-eight percent of those who changed majors (who represent 30% of all respondents) indicated that an unsatisfactory experience with introductory subjects contributed to their decision to change majors. It is important for students to try these introductory subjects early, so that they can learn which major is right for them; however, our current policies, grading systems, and messaging to first-year students encourage them to complete the GIRs early—taking up slots in their first-year schedule that could be used for major exploration. Eighty percent of the first-year class takes 3 or 4 science core GIRs in their first semester at MIT while on P/NR grading.

The problem is particularly acute for students who start at MIT with fewer Advanced Placement (AP), Advanced Standing (AS), or Transfer Credits (TC). Students with zero or one science core GIRs of advanced standing typically have much less opportunity to explore in the first-year than those with two or more science core GIRs of advanced standing. Moreover, as we discussed later in this report, the current study has shown that students who are open

to many majors (and thus more in need of opportunities for exploration) are more likely to have fewer incoming science core GIR credits. From the 2017 Student Quality of Life Survey, students with fewer credits to start their first year are statistically more likely to say they are dissatisfied with "your ability to balance academic and other aspects of your life," and are less likely to rate their academic experience as "very good" or "excellent." Consequently, for some students, the feeling that an initial major choice is a poor fit may not develop until the end of sophomore year. Moreover, 26% of respondents to the 2018 Perceptions of Academic Majors Survey did not agree that they have sufficient flexibility to change majors. As a result, there is sometimes a feeling of being "stuck" in a major. Few students consult with faculty or an advisor on major choice. We would like to make this sort of consultation a norm rather than an exception. More classroom interaction with more faculty, through taking a wider range of subjects in the first year, is a natural place to start. We are also working to improve advising in the first year to help address this and other needs.

We also note that since 2010 roughly a quarter of respondents to the MIT Senior Survey indicated they were generally or very dissatisfied with flexibility as an aspect of their major. Over this same period, MIT has had a consistently higher proportion of respondents dissatisfied with flexibility compared to peer schools.

The CUP also likely recalls that in 2013-2014 MIT launched the Institute-wide Task Force on the Future of MIT Education. The report called for "*an ecosystem that promotes educational connections across the Institute and provides an educational innovation hub, or a 'sandbox,' for conducting the experiments envisioned by the Task Force.*" Among other recommendations, the stakeholders endorsed introducing greater flexibility into the curriculum and re-examining the GIRs. The Task Force also encouraged "*bold experiments*."

Some of the most compelling answers to the question "why now?" can be found in the letters of support for this experiment from faculty, administrators, and students.

President Rafael Reif wrote:

> A thorough and thoughtful review of the GIRs will take time and careful consideration. For now, I hope you and your colleagues on the CUP will build on the momentum for change described here to authorize an experiment, one that I believe could prove invaluable in informing the longer-term discussion.

Chancellor Cynthia Barnhart wrote:

> I believe that we have an opportunity (as well as a responsibility) to demonstrate to our community that we take the challenges identified by the Designing the First-Year class seriously. This proposal is one immediate way to do that. Continuing the community conversation about potential transformations to the GIRs in the upcoming academic year is another. Because we owe this generation of students and the ones that will follow an exceptional first-year experience, I am hopeful that we can partner with the CUP to do both.

Provost Martin Schmidt wrote:

> I believe it is important that we capitalize on the momentum for change on campus to conduct such an experiment as soon as possible.... Our Institute has always favored serious self-reflection and what is working well, and what we could improve…. [I recommend] bringing to life, this valuable proposal.

President Alexa Martin '19 and Vice President Kathryn Jiang '20 of the Undergraduate Association wrote:

> We believe it is MIT's responsibility to take these recommendations very seriously and realize our students are currently being underserved. Changes need to be made in order to live up to the standard of education the world perceives MIT to be providing its students. We have a real opportunity to be innovators in the field of education, to be leaders amongst our peers, and to send a message to our students that we are listening and responding to their needs.

Dean of Science Michael Sipser wrote:

> Speaking on behalf of the department heads in the School of Science, I strongly and enthusiastically endorse the spirit of the proposal to conduct experiments to improve the undergraduate education experience, specifically around modifications to the GIRs.

Associate Dean of Engineering, Anette (Peko) Hosoi, wrote on behalf of the School of Engineering:

> We are strongly supportive of the concept of carrying out experiments so that we can learn and innovate our educational offerings. Much of the discourse on curricular change involves debating what might happen; continuing the debate does not necessarily lead to more knowledge. We must do experiments and test different hypotheses and do so regularly. We echo the call from the Task Force on the Future of MIT Education for pursuing bold experiments….

Herng Yi Cheng '18 wrote:

> I hope the Committee on the Undergraduate Program can take advantage of the debate and momentum generated by the Designing the First Year by supporting the proposed experiment, so as to deepen the conversation in our MIT way - with experimental data, and with greater collaboration.

Rachael Thompson, '21 wrote:

> Today, MIT is in a position of unique and exceptional opportunity to shape the future of higher education. Thousands of institutions look to our example. This proposal presents an opportunity to better meet students' need for exploration in their education and career. But more importantly, in staging an experiment and testing the proposed ideas, MIT is standing for innovation, exploration, and progress in education itself.

David Rich '19, expressed it as:

> In order to truly be the best, an institution must regard the needs of its members with utmost priority and with a sense of urgency. I love this school and I will until the day I die; all I ask now is to be given an opportunity to facilitate that love in other students. In this way, I truly believe MIT can be the best institution in the world.

We are in a fortuitous moment in time: we have a sense of urgency that change is needed, we have clearly defined needs, and we have a vision for how to create change. We recognize and appreciate the courage and hard work of the CUP and the broader MIT community to implement this experiment, and we hope that the lessons learned will help us strengthen the first year and the rest of the undergraduate academic experience at MIT. This experiment is fully in the spirit of MIT at its best: tackling hard problems, headfirst and hands-on.

SPECIFICS OF THE PHASE ONE EXPERIMENT

The primary control group is the Class of 2021 and their experiences and outcomes with the existing policies. For most of the regression analysis, the Classes of 2018 through 2021 are used as a control population[1].

The Phase One treatment group is the Class of 2022. Phase One is designed to enable opportunities for exploration in the first year by reducing the pressure to complete the GIRs in first year.

We emphasize that the standard for passing is a C or better, which is defined by MIT Rules and Regulations as:

> *Adequate performance, demonstrating an adequate understanding of the subject matter, an ability to handle relatively simple problems, and adequate preparation for moving on to more advanced work in the field.*

The Phase One policy as approved by the CUP is as follows:

> *First-year students entering during the Fall of 2018 will be eligible to designate up to three*

[1] Demographically, the Class of 2022 is only significantly different from the control population in that it has more URM students and a higher average number of science core GIRs satisfied through advanced credit. Detailed demographics may be found in Appendix A.

Science, Mathematics, and Engineering (SME[2]) General Institute Requirements (GIRs) to be graded on a Pass or No Record basis (P/NR) after their first term. Other regular MIT grading policies including first-year (freshman) grading remain in effect.

General guidelines:

- *Students may designate a total of up to three SME GIRS to be graded P/NR after the first semester (all subjects taken during the first semester will be graded P/NR).*
- *The SME GIRS to be graded P/NR should be so designated by Add Date of the semester in which the subject is being taken (this is the same deadline to designate Exploratory Subjects and Junior-Senior P/D/F).*
- *Regular deadlines for adding and dropping classes remain in effect.*
- *In an SME GIR taken under P/NR, a grade of P signifies C- or better performance.*
- *In an SME GIR taken under P/NR, a grade of D or F would be reflected as NR; students would earn no credit for subjects with D and F grades.*
- *First-year students who earn a grade of NR in an SME GIR under P/NR in their first semester or ABC/NR in their second semester will be required to retake the class. Students may subsequently designate that same subject as one of their three P/NR options or take it for regular grades.*
- *Upper-level students who earn a grade of NR in an SME GIR they have designated to be graded P/NR may retake it as many times as needed to pass on P/NR without using up an additional P/NR opportunity.*
- *Upper-level students who earn the grade of D in an SME GIR taken under P/NR may elect to switch the P/NR grading to regular grades so that a grade of D would count as passing. The grade will be reflected on their transcripts and will count towards their GPA. Students are still considered to have used their P/NR option for this class and may not elect an additional (fourth) class to take under P/NR. The deadline to request to change to regular grading for a particular subject is Registration Day of their next semester at MIT, except for final term seniors who must make this request by [Deadline TBD considering needs around graduation].*
- *There will be no change to Advanced Standing Exam (ASE) grading policies. Students cannot elect to take an ASE for an SME GIR under P/NR beyond their first semester.*
- *There will be no change to eligibility and policies around early sophomore standing related to this experiment. Students who are offered and elect early sophomore standing move to full grades and are considered upper-level students. They can elect three SME GIRs to take under P/NR starting that spring semester, and follow the policies for upper-level students stated above.*

Who is eligible:

- *Only students entering as first-year students during Fall 2018 are eligible.*
- *According the Regulations of the Faculty (2.84), students who do not graduate within ten years of first entry will normally be expected to fulfill the requirements of the class with which he or she graduates. The ability to continue to designate subjects under the above policy for students who seek readmission after ten years from their first entry to MIT will be evaluated on a case-by-case basis.*

ANTICIPATED STRENGTHS AND WEAKNESSES

The Phase One policy was written after seeking input from many members of the community and after considering a variety of alternatives. It was implemented under the belief that it strikes a balance between achieving the broader goals of exploration while minimizing risks. The large number of uncertainties associated with any particular policy permutation are an argument for the value of doing experiments.

[2] SME GIR is defined in this case to include Physics 1 (8.01, etc.), Physics 2 (8.02, etc.), Calculus 1 (18.01, etc.), Calculus 2 (18.02, etc.), Biology (7.01x), and Chemistry (3.091, 5.111, etc.), referred to elsewhere in this document as the “science core”.

While recognizing that students come to us with many interests and backgrounds and that one size definitely does not fit all, our general philosophy is that a well-balanced schedule in the first semester would include 2 science core GIRs and a HASS class, with the remaining 18 units used to explore different majors and fields or to explore personal interest and/or fulfillment. Depending on the student, 1 science core GIR, or 3 science core GIRs in the first semester may also be appropriate. However, we are trying to minimize the number of students who take 4 science core GIRs in the first semester. By limiting the number of GIRs that may be taken P/NR after the first semester to three, we are trying to prevent students from taking the entire first year on P/NR and experiencing ABC grading for the first time in their sophomore year. Therefore, the policy effect that we were seeking to achieve was a shift in scheduling of one class in the first year.

While Phase One does not explicitly require students to engage in exploratory opportunities, we expected that the increased flexibility would enable them to do so. We did explicitly encourage a diversified approach to exploration in the first year through advising and other communications. The diversified approach encompasses multiple fields and departments and multiple modes including first-year advising seminars, 1-3 unit classes, 6-12 unit classes, experiential learning opportunities like UROP, and co-curricular and extra-curricular programs. To ensure that students could take full advantage of the flexibility, we worked to develop and expand the list of opportunities to explore majors and minors. We also made curriculum development funds available immediately to departments that wished to develop new fall, IAP, and spring semester subjects which are designed for exploration of majors. Curriculum development funds continue to be offered in AY2020, though we have narrowed the scope of the call to focus on First-Year Discovery Subjects as described in the Phase Two policy.

We also collaborated with departments to develop and share roadmaps that enable students to have appropriate prerequisites going into sophomore year and enable them to thoughtfully explore with a knowledge of the opportunity costs of changing paths.

Phase One came with certain risks. The potential implications of the experimental policy, and the variations of it, are different depending on how many advanced placement, advanced standing, and transfer credits students have. It is important to recognize that we are starting from what some have called an “uneven playing field” in terms of the advanced credit that students have.

Anticipated benefits of Phase One:

- Making some of the GIRs P/NR after the first semester removes some of the pressure for first-year students to fill their schedule with GIRs in the fall (under P/NR), and/or in the spring (under the safety net of ABC/NR) at the expense of exploring majors.
- As noted by Associate Dean DiOnetta Jones Crayton, Director of the Office of Minority Education, “While these options will surely benefit all students, I think it is important to note that there may be a positive and disparate impact on those students who have done exceptionally well in their high schools but have not necessarily had the same opportunities (e.g. to take AP and IB coursework) that other students have had.”
- Limiting the number of science core GIRs which may be elected to be P/NR to something less than 6 maintains some incentive for students to perform under grades thus promoting a commitment to learning foundational material. It will also require that students have at least some subjects on grades first-year spring semester so we do not revert to an entire first-year on P/NR, which is something we very intentionally moved away from, establishing our current grading ramp of P/NR first semester and ABC/NR the second semester.
- Students have the flexibility to decide which subjects to take on P/NR or regular grades. A student could even decide to take no additional classes on P/NR after the first semester therefore recreating our current policies. Student choice of which subjects to take P/NR will also provide useful data as we move forward in the larger discussion of GIRs.
- The flexibility provided by the option may improve the overall undergraduate experience. Since 2010, about a quarter of the respondents to the MIT Senior Survey indicated they were generally or very dissatisfied with flexibility (e.g., time for electives) as an aspect of their major. Recent Senior Surveys show a growing proportion of very dissatisfied seniors (5% very dissatisfied with flexibility in 2014; 9% in 2018). MIT has a consistently higher proportion of respondents dissatisfied with flexibility compared to peer schools.

- The additional flexibility and the safety net of additional classes on P/NR may reduce some of the pace and pressure associated with our undergraduate curriculum. We note that on the 2017 MIT Student Quality of Life Survey, 25% of first-year students agreed with the statement "I feel that the academic environment negatively impacts my mental and emotional well-being." 48% of upper-level students agree with the statement. This sentiment was reinforced by data from the 2019 Enrolled Student Survey. For example, 65% of first-years said that they "felt overwhelmed by all they had to do" either "often" or "very often". This is a significant increase compared to the 49% who said the same when the survey was administered in 2015. For these reasons this policy is favored by Dr. Karen Singleton (Chief of MIT Mental Health Services) and David Randall (Senior Associate Dean for Student Support and Well-Being).

Anticipated risks of Phase One:

- Some students may take more advanced departmental subjects (for which they may not be prepared) in the first semester on P/NR to get ahead on a major instead of exploring multiple majors. This is mitigated but not eliminated by limiting the number of science core GIRs on P/NR to three. It can also be mitigated by advising and by asking faculty members to enforce the prerequisite requirements for their subjects more rigorously (and by having all students and advisors be aware of this).
- Some students may put less effort into the three science core GIRs on P/NR beyond the first semester and not learn as much. This could impact their performance in follow-on classes that rely on those GIRs as prerequisites. Again, this is mitigated but not eliminated by limiting the number of science core GIRs on P/NR to three and allowing students to opt-out of P/NR grading after the first semester if they desire.
- The policy does not enforce exploration, but rather tries to enable it by changing other incentives; this type of policy prescription is generally regarded as prone to unintended consequences (such as those described above).
- Greater attention must be paid to clearly communicating prerequisites and roadmaps for majors than we do currently (where many majors expect that students will have completed all the science core GIRs in the first-year).
- Greater attention must be paid to conveying the value of the GIRs to the students to prevent students from perceiving P/NR as lessening the importance of the GIRs.

Other indirect benefits from conducting a class-wide experiment are of note, even if difficult to measure. While the goal is to enhance the academic experience and promote more intellectual exploration, in so doing we expect there will be other positive outcomes.

- The experiment demonstrates how MIT is "listening to its students." It also sends a message that we are living up to our commitment to follow through on the recommendations of the "Designing the First-Year at MIT" class.
- Parents of undergraduates will likely appreciate (and expect) MIT's concern and attention to improving the first-year experience. Alumni have also expressed support: preserving the magic of MIT but making it better.
- The policy options described may promote improvements in health and well-being by reducing academic stress and the pressure to choose the right major, especially among the cohort of students who do not feel well-prepared to choose a major (27% in the Class of 2021 according to CUP Choice of Major Study Survey 5). As one recent alumni said, *"You can have all the puppy labs in the world, but if you do not fundamentally think about ways to improve the academic experience… it is all for nothing."*
- Improving the first-year may help with admissions yields, especially relative to cross-competes with other top schools. The following is a list of some of the reasons why admitted students say "no" to MIT:
    - too "narrow" in its educational focus and opportunities;
    - forces students to choose their path (i.e. major or field) too early, with no space or time to explore;
    - want more access to liberal arts people, topics, and concerns; putting STEM in a social context;
    - too "soul crushing, stressful, depressing" in a way that makes all the above worse.

RESEARCH QUESTIONS

We are using quasi-experimental research methods of social science to evaluate the consequences of the Phase One policies. Outcomes of interest include a set of objective and subjective measures related to students' undergraduate career at MIT. Objective measures are related to academic progress, while subjective measures include health and well-being and self-assessments and opinions about the MIT experience collected through surveys and interviews. Our surveys and interviews have their roots in the tools used as part of the CUP Study Group on Undergraduate Majors Selection study of the Class of 2021.

Our hypothesis was that increased flexibility to enable major exploration would lead to increased confidence in the initial choice of a major and increased satisfaction with the ultimate major (i.e., fewer students who say that if they had to do it again, they would have picked a different major). It may also diversify and improve the undergraduate experience as a whole, encouraging students to engage in a wider range of academic opportunities. This may lead to greater overall satisfaction with the undergraduate experience at MIT, and possibly to improved academic performance and reduced stress.

To that end, we proposed to examine treatment effects on the following outcomes:

I. From administrative data

- A. Take-up
    - a. Which departments, programs, and fields are explored?
    - b. Which science core GIRs do students choose to take P/NR vs. on grades?
- B. Programmatic
    - a. GIR completion timing.
    - b. Number and timing of HASS, major, and exploratory classes.
    - c. Program diversity: The number of departments to which a student has exposure.
    - d. Subject distribution: The concentration of subject enrollment measured by something like a Gini coefficient (an elaboration on a. and b.).
    - e. Choice of majors, including timing (e.g. through early sophomore standing).
    - f. Fields of internships, UROPs, global and other experiences.
    - g. Major switching.
- C. Academic
    - a. Fifth-week flags.
    - b. CAP actions, including warnings.
    - c. Add/Drop patterns for subjects including the science core GIRs.
    - d. Credit completion, academic probation, withdrawal or transfers.
    - e. Grades in general, including OX grades, and specifically in science core GIR subjects and subjects for which science core GIRs are prerequisites.
- D. Health and well-being
    - a. S3 authorized leaves and days missed.
    - b. Aggregate mental health data.

II. From survey data

- A. Student experience reports, including duplicating aspects of the CUP Study on Undergraduate Majors Selection with the Classes of 2022 and 2023.
- B. Student satisfaction, climate indicators, self-assessments of stress, and other data from various institutional surveys including the Survey of New Students (Summer 2018), the Enrolled Student Survey (Spring 2019), the Student Quality of Life Survey (Spring 2021), the Senior Survey (Spring 2022) and the Perceptions of Majors Survey.

For all of the above objective and subjective measures, we are investigating how the outcomes vary with student characteristics, such as level of preparation, incoming Advanced Placement credit, qualified transfer credit and other advanced standing credit, URM status, gender, socioeconomic factors, and first-generation status.

We are also collecting input from faculty and staff about their experiences with the experimental policies and hope to do so in a way that gives balanced input.

FALL SEMESTER DATA

Fall semester data was shared with the CUP during Spring 2019 to inform the Phase Two Experiment policy. It is included here as part of the larger discussion of the first-year experience for the Class of 2022. In summary, students behaved as hypothesized during the fall semester. On average, half of the students chose to take one fewer science core GIRs in their first semester and instead used the time to explore a wide range of other subjects.

FALL REGISTRATION

The following enrollment data is courtesy of the Registrar's Office and reflects student registration as of the fifth week of the specified term. The term "science core GIRs" refers to the following general institute requirements: Physics 1 (8.01 and variants), Physics 2 (8.02 and variants), Calculus 1 (18.01 and variants), Calculus 2 (18.02 and variants), Chemistry (3.091, 5.111, and variants), and Biology (7.01x and variants). "Advanced Credit" refers to credit awarded via an advanced standing exam, transfer credit, or an Advanced Placement test.

There were 538 fewer enrollments in science core GIR subjects during the fall of 2018 compared to the fall of 2017, with most students choosing to take Biology or Chemistry later as shown in Figure 3. This corresponds roughly to one fewer science core GIRs being taken by half the students. Table 1 shows the distribution as a function of advanced standing credit. Overall 44% of the 2018 class took three or more science core GIRs in the first semester compared to 77% in 2017.

Figure 1: Fall Enrollment in science core GIRs by First-Year Students

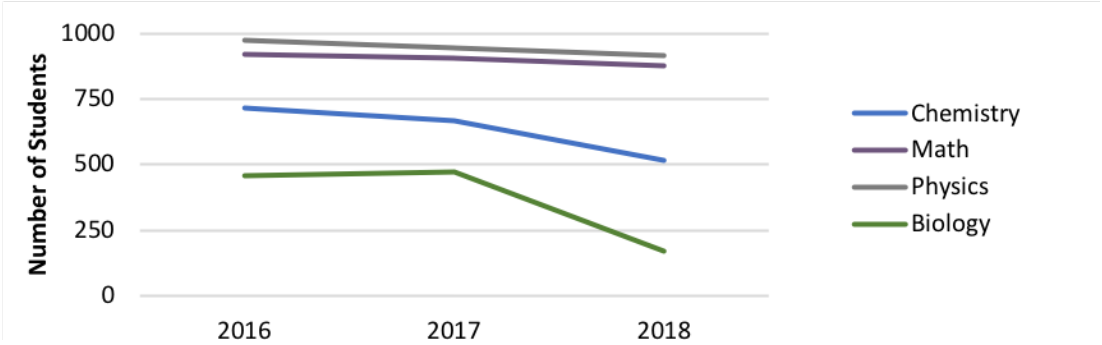


Table 1: Change in number of science core GIRs taken under experimental policy – Fall Semester

Advanced credit	Fall 2017					Fall 2018				
	0	***1***	***2***	***3***	***4***	***0***	***1***	***2***	***3***	***4***
0	0%	0%	4%	91%	5%	0%	2%	31%	67%	1%
1	0%	0%	9%	90%	3%	0%	2%	44%	53%	0%
2	0%	3%	36%	62%	0%	1%	17%	50%	32%	0%
3+	14%	33%	45%	9%	0%	38%	33%	26%	3%	0%
Total	2%	5%	16%	74%	3%	6%	10%	39%	44%	0%

As shown in Table 2, while many first-year students arrive with credit for one or more GIRs or test out of some through Advanced Standing Exams offered during orientation, roughly a quarter of the class each year does not enter with credit for any science core GIRs. Nearly half of the first-year students have credit for only one GIR. Most of this credit is for 18.01, which, until recently, could be satisfied with a score of 5 on the AP Calculus BC exam.

Table 2: Percent of students with science core GIR credits through Advanced Credit

Advanced Credit	Fall 2017	Fall 2018
0	27%	22%
1	42%	42%
2	17%	19%
3+	13%	16%

EXPLORING AND PREPARING FOR MAJORS

The registration, survey, and interview data suggest that students took a broad approach to exploration. While first-year students are always free to enroll in science core GIRs or to take other subjects, provided they have the necessary prerequisites, they were explicitly encouraged to postpone one science core GIR subject and use the time to explore. During orientation, they were given a list of subjects that the departments deemed suitable for exploring. Seventy-five percent of the new enrollments enabled by the decreased enrollments in science core subjects were spread among these 190 Academic Exploration Subjects identified by departments.

Additionally, the total number of unique subjects first-years took in the first semester increased by 14% (from 280 to 318). Only six subjects in the fall term had enrollment increases of 20 or more first-year students and, where needed, OVC provided TA funding to departments to support the additional students.

Table 3: First-year Fall enrollment in subjects beyond science core GIRs by School

School	Fall 2017	Fall 2018	% Change
Sloan	14	30	+114%
SA&P	113	134	+19%
Science	299	498	+67%
SHASS	1,012	1,092	+8%
Engineering	637	935	+47%
Total	**2,366**	**2,924**	**+23%**

Students in the Class of 2022 took subjects across more of MIT's schools than previous cohorts. The average number of schools represented by first-year fall registrations went from 2.6 to 2.9 (an increase of 0.4 standard deviations after adjusting for demographics, advanced credit, and intended major).

One-on-one interviews with first-year students in the Class of 2022 helped illustrate some of their many approaches to exploration. The interviews reinforced the preliminary findings of the CUP Study Group on Undergraduate Major Selection which found that students can be categorized as *focused* (firm about their desired major at entry and seek to engage and explore within that major), *focused/open* (have 2-4 majors in mind and seek to explore to choose among them), and *open* (no idea what their major will be and seek to explore to discover their major interest). These students use the flexibility provided by the experimental policy differently.

A few quotations from these interviews are included below:

> *Open student: I think for me though, since I don't know what I want to major in, it's really hard to just start exploring right away. I sort of feel like GIRs are an exploration, since they are still like Chemistry and Biology and all those things are still intro level, and if I enjoy one of them then I might continue with it.*
>
> *Focused student: What the policy has enabled me to do is take more higher-level classes, maybe what a sophomore fall would take, or a freshman spring would take, in my freshman fall, and really get exposed to the subject itself. I think allowing us to learn at like a faster pace, move ahead in the curriculum, is really helpful, because it's more exploratory in nature.*
>
> *I feel like you can't model what this career will be through just one class or just like a class in general. I feel like you have to go out and see what it's actually like about like working and stuff or trying to figure out what your major is.*
>
> *Open student: I think it would be kind of cool if like we offered more exploratory 6 credit classes… But if you do like three or four of that kind of class, in different areas, you get to explore it. And also, you have less work, so it's not that much commitment, which also enables you to take more.*
>
> *Open student: So I feel pretty lucky to have had the opportunity to not have to take all of my GIRs right now, to be able to incorporate some possible majors into my courses, especially because I didn't know what I wanted to major in once I got here.*

Some students chose to take subjects in the major they listed on their application. The percentage of fall subjects taken in these listed majors increased this year (8% in Fall 2016, 9% in Fall 2017, and 12% in Fall 2018). The increase is statistically significant. These are likely students we would categorize in the "focused" or perhaps the "focused/open" groups. There was also a statistically significant increase in the percent of subjects taken by early sophomores that were in the major they declared (18% in Fall 2016, 19% in Fall 2017, and 25% in Fall 2018). These data do not distinguish between students choosing to take these subjects to get major requirements out of the way and students choosing to take these subjects to explore the major.

We also collected data on student priorities in the post-orientation survey that is run each year. The survey asks about their orientation and move-in experience as well as their priorities and experiences when they selected their subjects. Many of the questions were asked in last year's survey as well, allowing us to compare the priorities of this class to the priorities of the previous class. Additional questions about exploration were added this year, giving us more detailed insight into how students approach major exploration, although not in a way that can be compared to past years. The survey results presented in Figure 2 show that the class entering in 2018 placed greater weight on opportunities to explore when choosing their subjects (a reflection of our efforts to change our messaging). They were also exploring in many ways as shown in Figure 3. Figure 4 shows that a significant fraction of the class attributed taking fewer science core GIRs to the experimental policy, consistent with the registration data shown in Table 1.

Figure 2: "When you chose your classes, how important were the following?" (data from Orientation Survey)

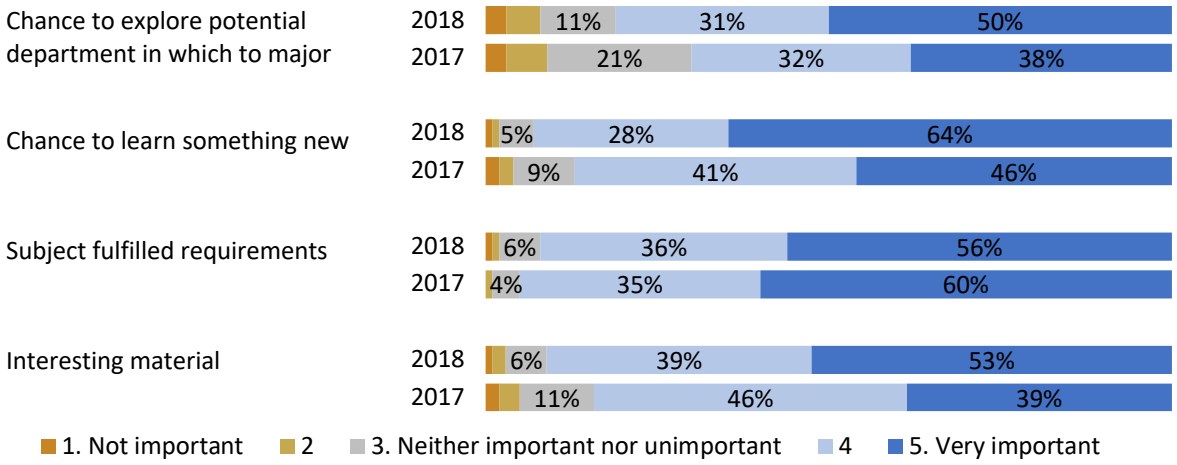
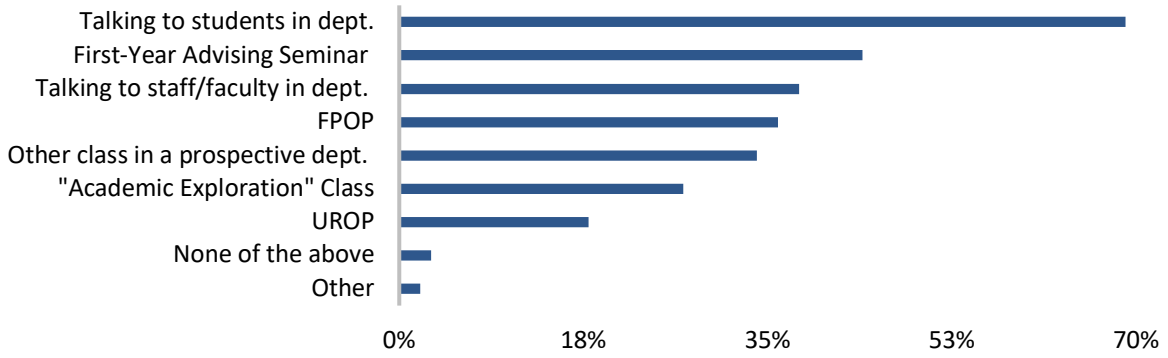


Figure 3: "In what ways are you exploring different academic fields, majors, and minors this first semester? (mark all that apply)" (data from Orientation Survey)

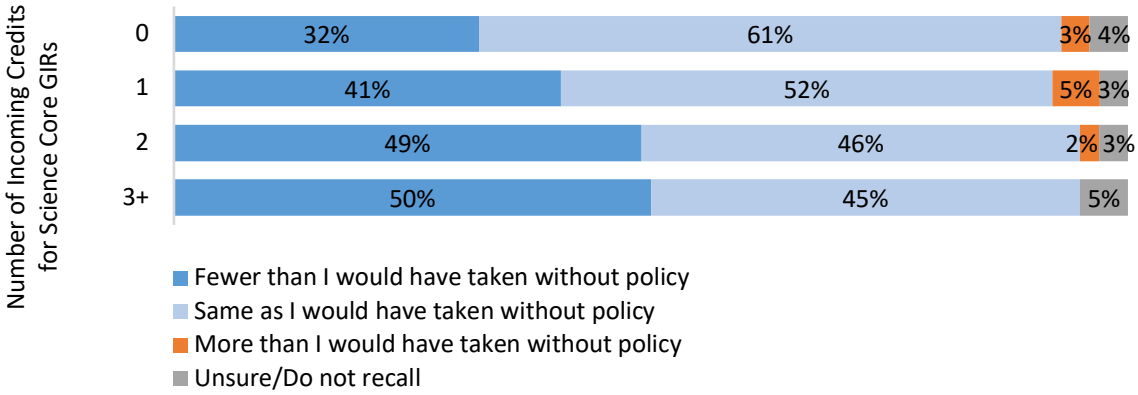


It is worth noting that at a mid-year point (January) there were not statistically significant variations in student feelings of preparedness to choose a major between the Class of 2021 and the Class of 2022. Sixty-five percent of the respondents in IAP 2018 and 64% in IAP 2019 either "somewhat agreed" or "strongly agreed" with the statement "I feel prepared to choose my major" at the mid-point of the academic year (data from the CUP Study Group on Undergraduate Majors Selection Survey #3 and FYX IAP 2019 Survey, respectively). We also noted the following changes relative to last year:

- % open to having their mind changed about a major has increased (78%—>85%)
- % finding the major decision process stressful has decreased (48%—>43%)
- % who want to explore majors they do not know much about has increased (53%—>59%)
- % whose level of major choice stress has increased since coming to MIT has decreased (46%—>39%)

However, given the small sample size of the CUP Study Group survey, these have low statistical significance.

Figure 4: "How did the experimental P/NR GIR policy affect your choice of how many science core GIRs to take during the fall semester?" (data from FYX IAP 2019 Survey)



As shown in Figure 4, we also found that students with fewer incoming credits were less likely to indicate that the policy reduced the number of science core GIRs they decided to take during the fall semester. This is consistent with the regression analysis that was performed on the fall registration data as shown in Table 4. For the model with all factors included (columns 3, 6, 9, and 12), students with no advanced credit (column 3) took 0.34 fewer science core GIRs on average, compared to 0.48, 0.45, and 0.59 fewer for students with one, two, or three or more advanced credits, respectively (columns 6, 9 and 12 respectively). Other interesting effects observed included a slightly weaker policy effect for female students: female students in the Class of 2022 took 0.41 fewer science core GIRs on average whereas their male counterparts took 0.53 fewer science core GIRs. International students experienced a stronger policy effect than students from the United States, with an average reduction of 0.15 science core GIRs beyond the average effects for their class.

Table 4: Number of science core GIRs taken Fall term split by number of incoming science core GIR credits (AP/AS/TC)

	0			1			2			3+		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Class of 2022	-0.340***	-0.342***	-0.342***	-0.480***	-0.481***	-0.480***	-0.476***	-0.466***	-0.454***	-0.560***	-0.588***	-0.591***
	(0.025)	(0.025)	(0.025)	(0.021)	(0.021)	(0.021)	(0.049)	(0.050)	(0.050)	(0.071)	(0.069)	(0.069)
Female		0.045*	0.030		0.059**	0.047*		0.113*	0.106*		0.320***	0.263***
		(0.022)	(0.022)		(0.020)	(0.020)		(0.046)	(0.047)		(0.068)	(0.068)
Asian		-0.036	-0.031		-0.034	-0.023		-0.171***	-0.145**		-0.369***	-0.426***
		(0.031)	(0.032)		(0.023)	(0.023)		(0.052)	(0.051)		(0.081)	(0.082)
URM		-0.008	-0.014		-0.002	0.001		-0.034	-0.012		0.204	0.094
		(0.025)	(0.025)		(0.025)	(0.025)		(0.065)	(0.064)		(0.140)	(0.141)
International		-0.059	-0.043		-0.127**	-0.093*		-0.136	-0.109		-0.424***	-0.420***
		(0.036)	(0.036)		(0.041)	(0.041)		(0.091)	(0.091)		(0.111)	(0.112)
First Gen		-0.005	-0.002		0.030	0.021		0.004	0.007		0.222	0.168
		(0.028)	(0.028)		(0.027)	(0.027)		(0.074)	(0.073)		(0.138)	(0.139)
Family Income[1]	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Anticipated major[2]	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
Observations	1119	1119	1119	1867	1867	1867	830	830	830	608	608	608

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$

Sample is all undergraduate students on campus for Fall AY2019, N=4,424.

[1] Family income is annual income categorized into $50K bands ranging from 'Less than $50K' to 'Greater than $300K along with an indicator variable for whether the student applied for financial aid (family income is unknown for those who do not apply).

[2] Anticipated major from admissions application. Majors grouped into MIT departments along with 'Engineering (unspecified),' 'Science(unspecified),' and 'Other/Unknown/Undecided.'

A major reason cited by students for not modifying their behavior was the need to use certain GIRs as prerequisites for their intended major. Table 5 demonstrates the difference in policy effect for those students who

indicated an interest in a life-sciences-related major[3] on their application. Students in the Class of 2022 who indicated an interest in a life sciences field on their application took an average of 0.260 fewer science core GIRs, all else being equal. Students who did not indicate a life science interest, by comparison, took 0.495 fewer GIRs on average. Life sciences majors were most likely to require chemistry and/or biology as a prerequisite for sophomore subjects. For students who chose to take advantage of the policy in their first semester, chemistry and biology were the most commonly postponed science core GIRs. Moreover, we explicitly advised students who are interested in pre-health (~ 10% of the class and a significant fraction of those interested in the life sciences) not to take advantage of the P/NR policy as we are unsure of how medical schools will view additional P/NR grades on student records.

Table 5: Number of science core GIRs taken Fall term split by Interest in Life Sciences Major (Y/N)

	Yes			No		
	(1)	(2)	(3)	(4)	(5)	(6)
Class of 2022	-0.300***	-0.303***	-0.260***	-0.546***	-0.554***	-0.495***
	(0.050)	(0.049)	(0.039)	(0.028)	(0.026)	(0.020)
Female		0.222***	0.078*		0.304***	0.107***
		(0.043)	(0.035)		(0.024)	(0.018)
Asian		-0.306***	-0.098*		-0.440***	-0.095***
		(0.049)	(0.040)		(0.029)	(0.022)
URM		0.019	-0.050		0.044	-0.024
		(0.057)	(0.045)		(0.032)	(0.024)
International		-0.182*	0.004		-0.410***	-0.174***
		(0.092)	(0.073)		(0.044)	(0.033)
First Gen		-0.019	-0.087		0.198***	0.043
		(0.069)	(0.055)		(0.034)	(0.026)
Family Income[1]	No	Yes	Yes	No	Yes	Yes
Incoming SME GIR credit[2]	No	No	Yes	No	No	Yes
Anticipated major[3]	No	No	Yes	No	No	Yes
Observations	710	710	710	3714	3714	3714

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$

Sample is all undergraduate students on campus for Fall AY2019, N=4,424.

[1] Family income is annual income categorized into $50K bands ranging from 'Less than $50K' to 'Greater than $300K along with an indicator variable for whether the student applied for financial aid (family income is unknown for those who do not apply).

[2] Incoming credit ranges from 0 to 6 and is the number of SME GIRs earned through AP credit, transfer credit, or Advanced Standing Exams.

[3] Anticipated major from admissions application. Majors grouped into MIT departments along with 'Engineering (unspecified),' 'Science(unspecified),' and 'Other/Unknown/Undecided.'

Prerequisites came into play for majors beyond the life sciences as well, as expressed by multiple students during the one-on-one interviews:

> *So course 10, being one of the more restrictive courses, and especially having so many classes with prerequisites, I just kind of knew I had to get my GIRs out of the way.*

> *I wanted to take a mechanical engineering course, but those have like a billion pre-reqs -- like I have to take Differential Equations first and all that. And I looked at a couple other departments, but I didn't find anything that I really wanted to take that I could take as a freshman first semester, so I ended up just taking three GIRs.*

[3] "Life-sciences-related majors" are students interested in Courses 7, 9, 20 and/or are pre-med.

Other students expressed a need to catch up with their peers, citing fewer opportunities in high school:

> *In a sense the PNR for the whole year I felt really only affected people who had a very strong background coming in… my school didn't have AP credits, so in the end I still wanted to get most of my GIRs out of the way so that I could start taking classes I liked later on….for someone like me or my friends who don't have AP credit or came from like international schools where there was no AP or IB credit it's kind of like we're still here taking the GIRs.*

Regarding this last observation, it is not clear that it would change with additional P/NR flexibility since the students are responding to our overall GIR requirements and pre-requisite structure. Therefore, in the proposal for Phase Two of the experiment we recommended changes to the credit unit limit (to exempt certain light load subjects that are explicitly designed to enable discovery). The credit unit limit has a strong influence on student subject registration in the first year.

FALL GRADES

Overall in the fall semester, the students in the Class of 2022 performed at least as well as their peers in the Classes of 2019 through 2021. When controlling for a variety of factors through regression analysis, the overall change in GPA based on hidden grades was +0.06 (statistically significant at $p < 0.01$ level). The GPA for science core GIRs also saw a +0.06 increase ($p < 0.05$), as did HASS GIRs with a +0.06 increase ($p < 0.01$). There was no significant change in GPA in subjects in students' eventual declared major or in non-science core subjects collectively. There was no significant change in the rate of CAP (Committee on Academic Performance) actions, which was anticipated due to their low overall frequency, however we did observe a small decrease in the number of students who were flagged for CAP review.

We also monitored the performance of students who elected to register for classes for which they did not have the prerequisites (and were permitted to do so by the teaching staff). We note that we explicitly encouraged faculty to enforce prerequisites (some did, some did not as is their prerogative). We told all of the first-year students, first-year advisors, and associate advisors that the faculty would be enforcing the prerequisites. Our data does not allow us to easily determine who these students were and what their performance was. For the few cases we have analyzed the N was small and the effects were not significant. For example, in fall 2017, 15 first-year students took graduate-level classes. In fall 2018, 21 students did so. Almost all of these students received A's in the classes (and did better on average than the prior year, but again, the numbers are too small to be significant).

A specific case that sparked concern for several faculty members was 6.042/18.062: Mathematics for Computer Science. The subject experienced a significant increase in first-year student enrollments, and some faculty members worried about the students' ability to effectively learn the fundamental material taught in the course. The students typically had satisfied the prerequisite (18.01). Overall, the students performed well, but there was a reduction in average hidden grades for the subject. We analyzed first-year student performance over a five-year period and determined that the reduction in grades can be explained by the mean number of advanced credits of first-year students in the subject (which was reduced from 2.5 to 1.8). This suggests that if the performance in the class is judged to be less than desired, additional prerequisites may be an appropriate response. We also noted a statistically significant reduction in GPA for upper-level students as well which suggests that other factors were at play. We will continue to monitor student performance in follow-on subjects.

SPRING SEMESTER DATA

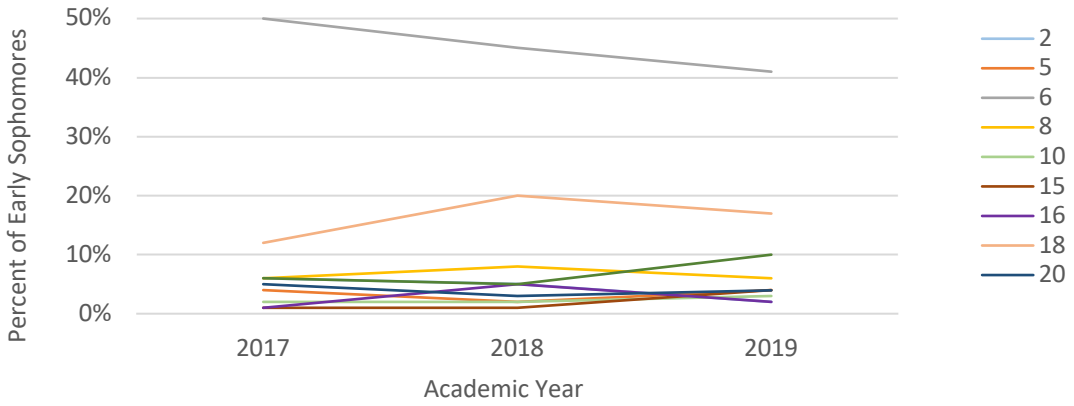
While initial registration data and early sophomore major declarations were used to inform the Phase Two experiment, most of the Spring 2019 data was collected and analyzed after the Phase Two policy was set. The

following enrollment data is courtesy of the Registrar's Office and reflects student registration as of the fifth week of the specified term.

EARLY SOPHOMORES

Figure 5 shows the top ten majors declared by early sophomores over the past three years. Notably, the total number of unique majors declared by at least one early sophomore increased from 17 in Spring 2018 to 19 in Spring 2019.

Figure 5: Percent of Early Sophomores in Each Major (Top 10)



SPRING REGISTRATION

As in the fall, the number of unique subjects taken in the spring increased, but only by 7% (from 403 to 431). Eight subjects had increases of 20 or more first-year students, but only two had increases of more than 30. The distribution of non-science-core enrollments among MIT's five Schools for spring semester is shown in Table 7.

Table 6: First-year Spring enrollment in subjects beyond science core GIRs by School

School	Spring 2018	Spring 2019	% Change
Sloan	51	179	+251%
SA&P	100	96	-4%
Science	1,029	1,141	+11%
SHASS	961	997	+4%
Engineering	1,627	1,819	+12%
Other	331	242	-27%
Total	**4,099**	**4,474**	**+9%**

During the spring term, the reduction in GIR enrollments was less significant, with only 183 fewer enrollments in science core GIRs in Spring 2019 as compared to Spring 2018. The change by subject is shown below in Figure 6. Table 7 shows the distribution as a function of advanced credit. Overall 28% of the class in 2019 registered for two or more science core GIRs in the spring semester compared to 38% in 2018.

Figure 6: Spring Enrollment in science core GIRs by First-Year Students

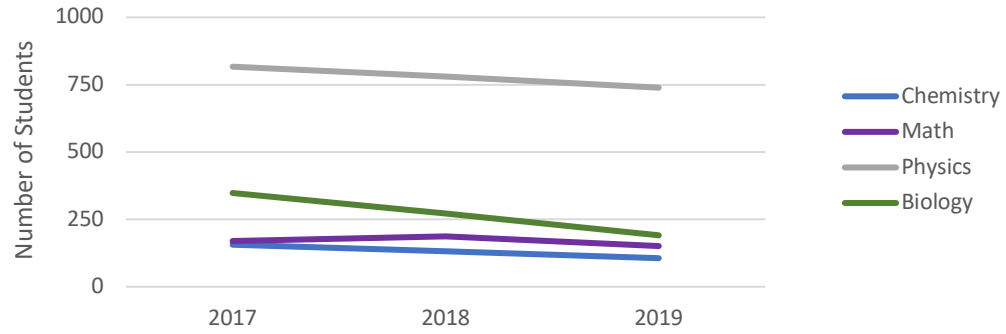


Table 7: Change in number of science core GIRs taken under experimental policy – Spring Semester

	Spring 2018				Spring 2019			
Advanced Credit	0	1	2	3	0	1	2	3
0	4%	36%	40%	21%	4%	39%	45%	12%
1	5%	50%	43%	2%	9%	61%	28%	2%
2	38%	53%	9%	0%	44%	46%	10%	0%
3+	67%	32%	1%	0%	63%	34%	3%	0%
Total	19%	44%	31%	7%	23%	49%	24%	4%

Given that our messaging suggested that students take most of their science core GIRs in the first year but leave one or two for subsequent years, we also examined how many science core GIRs each student had remaining after their first year. The percentage of the class with different numbers of science core GIRs remaining is shown in Table 8.

Table 8: Percentage of first-year class with different numbers of science core GIRs remaining after first year

Science core GIRs left after first year	**AY2017**	**AY2018**	**AY2019**
0	50%	45%	20%
1	44%	46%	40%
2	5%	8%	31%
3	1%	2%	7%
4	0%	0%	2%
5 or 6	<1%	<1%	<1%

Of the students who took science core GIRs during Spring 2019, more than half chose to do so on P/NR. Table 9 shows the percent of students (among those taking any science core GIRs) who took science core GIRs entirely on P/NR, mixing P/NR and grades, and entirely on grades. Table 10 shows the percent of students in each GIR subject electing regular grading (ABC/NR or ABCDF depending on early sophomore status) or P/NR.

Table 9: Percent of students taking science core GIRs during spring semester electing each grading type

Advanced credit	All P/NR	Some P/NR	All ABC
0	65%	15%	20%
1	74%	8%	19%
2	70%	2%	27%
3+	70%	0%	30%
Total	70%	8%	21%

Table 10: Percent of students by science core GIR subject number electing each grading type

Subject	Category	ABC	P/NR
7.013	Biology	37%	63%
7.014	Biology	15%	85%
ES.7013	Biology	33%	67%
3.091	Chemistry	19%	81%
5.111	Chemistry	48%	52%
ES.5111	Chemistry	50%	50%
18.01	Math 1	88%	13%
18.02	Math 2	45%	55%
18.02A	Math 2	20%	80%
ES.1802	Math 2	25%	75%
8.011	Physics 1	27%	73%
8.02	Physics 2	19%	81%
8.022	Physics 2	28%	72%
CC.802	Physics 2	25%	75%
ES.802	Physics 2	23%	77%
ES.8022	Physics 2	0%	100%

As shown in Table 11, students categorized as "Open"[4] had fewer advanced credits for science core GIRs on average (1.2 compared to 1.5 or 1.6). We hypothesize that because they may have felt "behind" and needed science core GIRs for prerequisites for majors, they took more science core GIRs in the fall and spring. This left them with less opportunity to take subjects in their major of interest in the first year, and less time to take Academic Exploration subjects. However, by the end of the spring semester, they passed the students who are focused or focused/open in terms of completing science core GIRs, but at the expense of exploration. They are the group that may benefit most from the Phase Two proposal.

Table 11: How do students behave along the focused-open spectrum? (categories from SNS 2018)

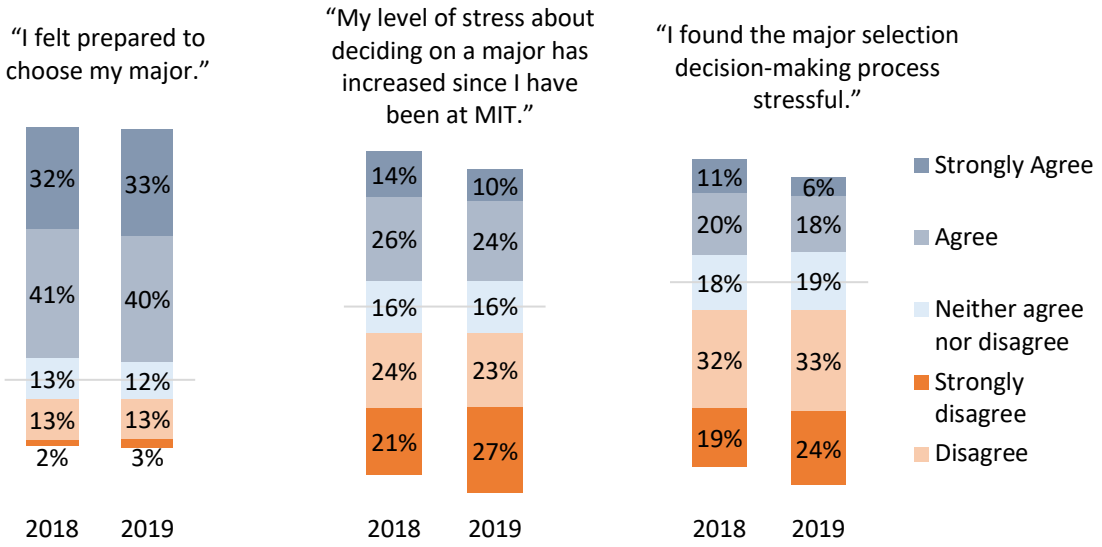
	Focused	Focused/Open	Open	Did not answer SNS
% of fall subjects in Application major	14%	14%	9%	13%
% of fall subjects matching Early Sophomore major	23%	27%	19%	30%
# Advanced credit (avg)	1.6	1.5	1.2	1.4
# Fall Sci. Core GIRs (avg)	2.1	2.2	2.5	2.1
# Fall Exploratory Subjects (avg)	1.1	1.2	1	1.2
# Spring Sci. Core GIRS (avg)	1	1	1.2	1
# GIRs remaining after FY (avg)	1.3	1.3	1.1	1.4

[4] Categories are defined based on interviews conducted during the CUP Choice of Major Study. The experimental cohort is classified based on responses to major-related questions on the 2018 Survey of New Students.

CHOICE OF MAJOR

We surveyed students in late April, as most were declaring their majors, to learn more about their major selection process and how it compared to the control group. There was no statistically significant change in feeling prepared to choose a major, but there were drops in stress associated with the process as seen in Figure 7.

Figure 7: CUP Choice of Major Survey 5 (2018) vs. FYX Major Declaration Survey (2019)



While stress related to choosing a major decreased slightly, overall stress as measured by questions on the 2018 Enrolled Student Survey increased since the last survey administration in 2015. This increase occurred across class years and was comparable to increases at peer schools. We have not observed a correlation between overall stress and this experiment, however some students mentioned in the spring interviews that P/NR alleviated some of the stress they associated with their science core subjects.

> *Maybe this will change as I progress at MIT, but the person I currently am could like take all of MIT P/NR, I would still be like sitting there trying to finish the p-sets. So I think that for maybe for some people, taking something like P/NR gives them too much of a pass and they up getting a C-minus and not learning anything. But I think for me, P/NR gives me the confidence to not worry about the A-minus.*

> *I think there was a little bit of an instance a couple weeks ago where I got a not super great grade on one of my midterms…I did the math and I realized there was no way I could get an A in the class. And for a moment I was like, 'oh, my god, what am I going to do; my life is over.' And then it was really that experience of like, 'wait, why does this matter? Like grades aren't– like I'm not here for the grades, I'm here for the experience and the learning. The grades are just something that are there. They're, in a sense, an indication of how well I know the material, but they're not always representative. And as long as I'm self-aware of that, then that's all that matters.' So I've had that like mini-breakdown a couple weeks ago, and then realized everything's okay. I think that's been the biggest difference. It's just like having to actually stop myself from spiraling into, 'oh, my god, everything's about the number; I just need the number.' Rather than being like, 'okay, am I actually getting the experience and the learning out of it.*

> *I'm the type of person who doesn't always do amazing under pressure. So when I suddenly have grades, I'm finding I get more nervous during exams and maybe put too much pressure. Like the classes, if I was on P/NR, maybe I'd be more relaxed. So I think it's working through that. And then also, I am doing more things on campus now. So I'm balancing more things.*

I mean, it also makes my life less stressful now, too, but I probably learn– I put less effort into it than I would otherwise. I shift time away from it. But I don't know. That's probably not the answer the administration wants to hear. [laughter] But I do tremendously enjoy having it P/NR. Particularly because I was apprehensive about this class because I thought it was going to be pretty hard.

In the spring interviews, students also mentioned that the increased opportunity to explore helped them feel less stress around their choice of major:

If I didn't have [the P/NR policy], I probably would not have taken 6.00 last semester, but replaced it with a biology, so that it could still be P/NR. And then I wouldn't have like realized, through 6.00, that I was not meant to be Course 6. Yeah, it's been helpful.

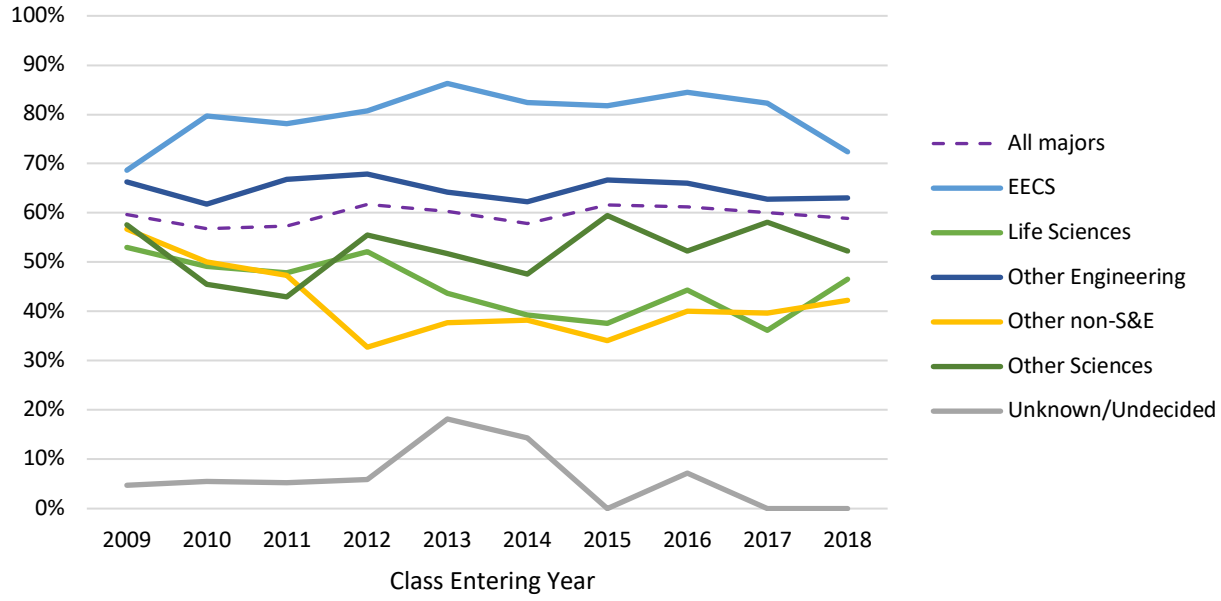
I probably would have taken my GIRs on P/NR which would have pushed other classes later. And then I might have ended up declaring a different major. And then planning on that major. And then realizing too late, 'Oh, this isn't actually what I want to do!', and then having that extra stress of trying to figure out what I want to do.

In terms of their actual choices, roughly half of the class declared the same major they listed as their interest when they applied to MIT over a year prior. Of the remaining 48%, 19% declared another major in the same school as the major they listed on their application, and 29% declared a major in a different school entirely. Table 12 shows how these numbers have varied over the past decade. Figure 8 shows the percentage of students who majored in the same general subject area as they listed on their application.

Table 12: Major Declared Compared to Major Listed on Application

Entering Year		Different School	Same School	Same Department
2010	N=904	26%	25%	49%
2011	N=959	27%	23%	50%
2012	N=992	27%	20%	53%
2013	N=967	25%	23%	52%
2014	N=935	24%	26%	50%
2015	N=992	22%	23%	55%
2016	N=1,035	27%	20%	53%
2017	N=1,036	25%	24%	51%
2018	N=1,044	29%	19%	52%

Figure 8: Percentage Declared Major Category Matches Application Major Category



SPRING GRADES

There was no change in overall hidden GPAs, but there was a statistically significant drop in science core hidden GPAs for the spring. Specific changes are in Table 13.

Table 13: Changes in Hidden GPA for Phase One Cohort

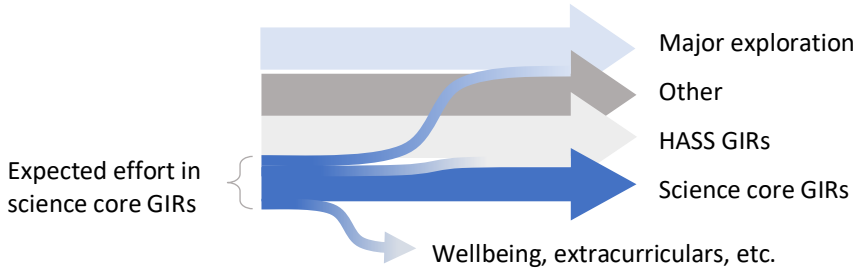
Subjects Included In Calculation	Spring Only	Full Year
Science Core GIRs	-0.36***	-0.05*
HASS GIRs	+0.08**	+0.07***
Subjects in declared major	+0.06*	+0.03
Overall	-0.05*	+0.01

*Sample is undergraduate classes of 2018 through 2022, changes based on regression analysis *p < 0.05 **p < 0.01 ***p < 0.001*

In the individual Spring 2019 science core GIR subjects, the only GIR with a significant change in average hidden grade was Physics 2, which saw a drop of 0.51 grade points. When looking specifically at rates of students receiving No Record for a subject, Physics 2 saw a statistically significant rise of 0.037 (3.7% more students receiving NR), while Chemistry saw a statistically significant drop of 0.029. The other science core subjects did not experience significant changes in rates of "No Record".

Figure 9: Redistribution of Effort

We hypothesized that students would redirect their effort such that the product of performance (as measured by GPA) times workload (as measured in units) would remain more or less the same as in past years. We have found that the first year GPA is the same as in the past, and the units were the same. We have found some evidence of students putting more energy into some things and less into others.



The extra energy dedicated to HASS GIRs and major exploration can be observed through GPA increases in those categories as well as interview data. The extra energy devoted to wellbeing and extracurriculars can be observed through interview data such as the following student quotations from the spring 2019 interviews:

> *I guess there are times when I can sort of let something go. For example, this last weekend I went back home to celebrate Easter with my family, and so I missed a p-set from a P/NR class in doing so. But like, oh, well, I'll miss one problem set, knowing that it's not really going to affect my grade that much in a P/NR class.*
>
> *I think freshman year especially, especially the fall when everything's on P/NR, I found it really helpful to get hands-on experience of like actually doing mech-e work because my classes first semester aren't going to be mech-e classes. I'll have to take the required GIRs and also prereqs before I actually get to experience a mech-e class. So I think that the role of an extracurricular like team or group or something like that really helped me develop my mech-e skills first of all, and then kind of see, 'Oh, I really like this, I'm going to pursue this.'*
>
> *So I think everyone dropped the last PSET, because everyone on a dance team, that's Prod week for us. So we have a lot of extra practices and rehearsals. And it's like, I do not have time to do a PSET. We're going to make this the drop PSET, and stuff like that. Yeah. So it was nice having that little break.*

ONGOING QUESTIONS AND CONCERNS

PREREQUISITES AND EXPLORATION

Some faculty have shared concerns about students taking subjects in their first year without the proper prerequisites. Other faculty have shared concerns about students failing to take the science core subjects that serve as prerequisites for sophomore-level subjects in their major of choice.

On the first issue, we do not have comprehensive data regarding students ignoring prerequisites generally, but brief analysis of a few select subjects indicates that observation of prerequisites largely depends on faculty efforts to enforce them. To that end, we have continually advised faculty to enforce their prerequisites and informed first-year students that faculty would do so. To ease the process, we also worked with the Registrar's Office to build self-service pre-requisite reports available via WebSIS in time for Fall 2019 registration.

The issue of completing prerequisites for majors is complicated by the fact that departments do not require certain subjects to be taken sophomore fall in accordance with faculty rules. Some departments have clear sequences of classes that may be started in the sophomore fall while others have tiers of classes or a broad set of electives with varying prerequisites. Therefore, any estimates of students "failing to complete prerequisites for sophomore fall" are based on listed prerequisites for *typical* sophomore fall subjects. When available, we used departmental roadmaps to identify these subjects. Based on a brief assessment, we noted some instances of increased completion of prerequisites and other instances of decreased completion. All changes observed impacted six or fewer students of the major, so it is unlikely that any would be statistically significant if we were to analyze them more carefully.

DEFINING "EXPLORATION"

A key disagreement around the definition of "exploration" is where the line should be between genuine exploration of a possible path and simply getting ahead on a major. Students tend to adopt a more liberal definition, describing their subject selection process in ways such as:

> *I wanted to take more Course 6 heavy classes that weren't necessarily the, I mean the I guess harder classes in terms of Course 6 classes go to see if it was actually something that interested me and if it was something that I wanted to continue pursuing.*
>
> -First-Year Student, fall 2018 interviews

Some faculty and instructors, however, view these students as simply getting ahead on majors and consequently neglecting their science core subjects:

> *They were taking classes in their predetermined major and still taking a few science GIRs, but they didn't care about the science GIRs because they were getting pass/no record and so they were focusing on their major. So they weren't using it for exploration, they were using it to get started on their major classes.*
>
> -Science core instructor, spring 2019 interviews

THE VALUE OF THE SCIENCE CORE GIRS

Faculty have expressed concerns that students are receiving information (either explicit or implicit) that the science core GIRs are not valuable. We note that our communications have consistently promoted the science core as important and foundational. We also note that survey data from the 2018 Perceptions of Academic Majors survey suggest that the science core subjects were not valued by many students *before* the experiment (with the specific subjects that are less or more valued being dependent on the student's major).

Furthermore, while both students and faculty value a "well-rounded" education, there exist differences in opinion about what that should look like.

Notably, some faculty view the science core as a broadening of what would otherwise be a narrow technical education.

> *I think since MIT is already a science and technology school you don't want to narrow people's scope more than what the school already kind of is making you somewhat narrow. You've got to let the students be exposed, expose the students to something more than just their narrow little major is, otherwise they're not well-rounded. I just feel like they're not well-rounded.*

-Science core professor, spring interviews

Some students, meanwhile, say that they saw the science core material already in high school and view disciplines like computer science as a better opportunity to broaden their knowledge and explore new fields.

> *A lot more people have suddenly realized they've had a love for CS rather than biology, because in high schools across our nation, computer science is an emerging thing at the high school level and biology is almost universally a high school requirement.*
>
> - First-year student, fall interviews

We maintain that there should be a critical assessment of the value that the science core subjects provide to our students in the interest of both increasing their value and communicating that value to our students.

GOVERNANCE AND NEXT STEPS

We note that some faculty feel that these experiments are a result of administrative overreach and/or things are moving too fast. Other faculty feel that change is happening too slowly and would like to see bolder changes.

Associate Dean of Engineering, Anette (Peko) Hosoi, wrote on behalf of the School of Engineering:

> I would like to return to the call from the Task Force on the Future of MIT Education to pursue bold experiments. Another piece of feedback I received (perhaps from those unscarred by previous attempts at education innovation) is that this proposal is not bold enough and that Option A could be viewed as "incremental." The leadership in the Dean's Office wholeheartedly supports the idealism of this new (unscarred) generation of educators and encourages the CUP and the Vice Chancellor to Think Big and to Think Bold. This proposal is a good start and we hope that it represents just the first step in an exciting new phase of educational experimentation at MIT.

A key challenge illuminated by the experiment is the lack of organizational structures for coordinating among the many stakeholders who share responsibility, authority, and control over the science core. It is our hope that the upcoming task force to discuss the GIRs (to be charged by the Vice Chancellor and the Chair of the Faculty) will address the issue of science core GIR governance and prescribe a clearer path for future innovation in and around the science core GIRs.

In the meantime, we expect that the faculty, under the guidance of the CUP, will address the following questions for the Class of 2024:

- Should we return to offering Early Sophomore Standing?
- What should the credit limits look like? Does a separate "discovery limit" provide value?
- Should we continue to offer 3 P/NR slots for science core subjects? Reduce to 2 P/NR slots? Some other variation? Or revert back to 0 P/NR slots?
- Should we consider other mechanisms to encourage exploration and discovery?

The decisions above will be impacted by several outcomes that emerge over AY2020, of which the following are a core subset:

- How did the experimental cohort perform in subjects with science core GIRs as prerequisites? How did sophomores perform in science core subjects taken on P/NR this term?
- How do the experimental credit limits impact first-year student grades and stress levels?
- Discovery vs. Exploration vs. Advising: How do students understand the many mechanisms for navigating their MIT world and how can we improve the quality and selection of these offerings?

LONGER TERM QUESTIONS

In closing, we note that these experiments are just part of a larger effort to improve the first year. Over the next few years, we hope to engage the MIT community in considering the following:

- How can we use our First-Year Learning Communities as incubators for educational change?
- How can we improve advising and mentoring in the first year?
- How can we continue to innovate on the content, structure, and pedagogy of the GIRs?

APPENDIX A: DEMOGRAPHICS OF REGRESSION SAMPLE

	Class of 2022	Classes of 2019-2021
N	1,114	3,310
Gender		
Male	51%	54%
Female	49%	46%
Race/Ethnicity		
White	30%	35%
Asian	36%	32%
URM	26%	22%
International	8%	10%
Parental Education		
First Generation	18%	17%
Family Income		
Less than $50K	16%	15%
$50K to $100K	16%	15%
$100K to $150K	13%	13%
$150K to $200K	10%	10%
$200K to $250K	7%	7%
$250K to $300K	6%	5%
Greater than $300K	14%	10%
No Financial Aid application[1]	18%	24%
Preparation		
Mean SME GIRs AP/ASE/Transfer	1.4	1.3

[1] Family income unknown for those who do not apply for financial aid.