Self-Study
The Harvey Mudd College Core Curriculum
November 2017

I. Introduction and Background

At just over sixty years old, Harvey Mudd College (HMC) has quickly become one of the foremost undergraduate institutions in the United States, ranking side-by-side with elite colleges that in many cases were founded more than a century before it. However, as with any institution, there are times of growth, change, and challenges. HMC is now facing similar challenges to those faced by many institutions of higher education across the country, namely, to continue our efforts to diversify our student body and faculty, and to make the College a welcoming place, both academically and personally, to all. HMC's Core Curriculum has felt this challenge acutely, as we bring into our courses students who have a wider range of high school preparation. These issues are layered on top of a longstanding challenge at the College, that of student and faculty workload. Students are offered rigorous courses throughout the Core, and typically take more than five of these each semester, resulting a demanding schedule that is sometimes overwhelming for all involved. One of the purposes of this study is to document what we know at this time about these challenges, to engage the entire HMC community in a productive conversation about these challenges, and to consider how we can move forward to vigorously engage these challenges.

I.I The History and Mission of Harvey Mudd College

Origins

In 1957, less than a month before Sputnik I launched the Space Age, HMC opened its doors. Forty-eight students and seven faculty members constituted the pioneers who shaped this unique institution born of the generosity of mining engineer, entrepreneur, and philanthropist Harvey Mudd, and the vision of Joseph B. Platt, nuclear physicist and first president of the College. The founders of HMC envisioned a distinctive educational experience for the College's students. The curriculum was designed to create excellent scientists and engineers with unusual breadth in their technical education accompanied by a firm grounding in the humanities and social sciences. Another important distinction was the teaching model: class sizes were low, and the interaction between students and faculty members was high; academic programs were demanding, but HMC fostered cooperation rather than competition through a student-directed Honor Code. All of these attributes are still at the heart of an HMC education.

Mission

To capture a sense of the HMC's mission and purpose, President Platt drafted a concise but challenging mission statement in 1956 that continues to guide our faculty, administration, and students:

> *Harvey Mudd College seeks to educate engineers, scientists, and mathematicians well versed in all of these areas and in the humanities and social sciences so that they may assume leadership in their fields with a clear understanding of the impact of their work on society.*

Harvey Mudd College Today

HMC today is a small residential college that is widely recognized for its programmatic innovation, excellence, and rigor. *U.S. News and World Report* has consistently ranked HMC among the top twenty undergraduate liberal arts colleges, noting in particular that the College has one of the best undergraduate

engineering programs in the nation, with 40% of recent graduates majoring in that field. HMC surpasses every other liberal arts college in the United States in the percentage of its graduates who go on to earn Ph.D.s in the sciences and engineering, and its alumni command high starting salaries in industry. The HMC's reputation rests on the excellence of its faculty and students, its independent spirit, the quality and innovation of its programs, and the high caliber of its graduates. Building on this strong reputation is one of the exciting challenges that awaits us as we review our Core Curriculum.

I.II The Academic Program

Curriculum and Pedagogy

Our founders envisioned a distinctive educational experience for HMC students and embodied that experience in the academic plan. The curriculum is divided into three components: the common Core Curriculum (Core), the major, and the program in humanities, social sciences, and the arts (HSA). Unifying all of these is an emphasis on strong oral and written communication, the development of computational skills, and direct experience with research or a Clinic project.

The Core—constructed of foundational courses from each department—is designed to provide essential knowledge for upper-division courses and expose students to the various STEM disciplines. Preparation through the Core enables students to address practical problems from a strong theoretical base of knowledge.

Six departments offer majors: biology, chemistry, computer science, engineering, mathematics, and physics. In addition, students may choose a joint major, an approved individual program of studies, or an off-campus major (completed at one of the other Claremont Colleges, and typically in the humanities and social sciences) with a technical minor.

The HSA program provides the liberal arts nature of an HMC education by strengthening humanistic and social scientific perspectives on key social and cultural issues. In addition to the HSA course in the Core, students take at least ten additional HSA courses (~30% of their coursework). To achieve depth and intellectual development in some area of the humanities, social sciences or the arts, each student must complete a concentration of at least four courses in a single HSA discipline or interdisciplinary area chosen from the distinct areas of study offered at the Claremont Colleges. To obtain breadth in the humanities, social sciences, and the arts and an understanding of the varieties of approaches that inform these disciplines, each student must fulfill the distribution requirement by completing at least one full course in each of five different HSA disciplines. The emphasis on HSA distinguishes the HMC curriculum from most other undergraduate programs in science and engineering. A growing number of HMC students further enhance their education by studying abroad.

The Clinic Program, a nationally recognized hallmark of HMC, engages students in the solution of real-world, technical problems for industry clients. Founded in 1963 as an innovation in engineering education, this program has been expanded to other departments within the College and has been copied by institutions worldwide. Since the Clinic Program was developed nearly forty years ago, more than 450 companies, agencies, and organizations have participated as clients in over 1,600 projects at HMC.

Our Clinic Program is only one example of HMC's commitment to active and project-based learning. In addition to employing active learning in more traditional course structures, faculty members emphasize active learning through small-group seminars, student-directed team projects, and independent study. Research, both in the technical disciplines and in the HSA department, is an important part of the HMC professor-student relationship. Students are engaged with faculty in research projects at all levels, during

the academic year and during the summer through nationally funded research grants. Many students co-author papers with their professors that are published in peer-reviewed journals. Current support for faculty research projects includes grants from the National Science Foundation, the National Institutes of Health, the Howard Hughes Medical Institute, the American Chemical Society-Petroleum Research Fund, the Netherlands Science Foundation, the Research Corporation, the German Federal Environmental Agency (UAB), and the Teagle Foundation. There are currently more than twenty active NSF grants under management by members of the HMC faculty. The college is also fortunate to have recently received funding from both the Mellon and Carnegie Foundations. The Mellon funding will support efforts to increase diversity among the faculty and to review and potentially revise the Core Curriculum. The Carnegie funds are to provide support for academic initiatives.

Faculty

HMC faculty members are committed teachers and mentors. They are also active and prolific scholars and consultants, and many have national and international reputations in their fields. In fall of 2017, there are 100 full-time faculty members, all of whom hold a terminal degree in their field. Among the full time faculty, the majority (75%) are tenured. Faculty of color constitute 26% of the full-time faculty; women constitute 39%. HMC does not rely heavily on contingent faculty: in fall 2017, there are 19 contingent faculty, including two post-doctoral scholars. They constitute 11 full-time-equivalent faculty positions. The faculty promotes an intimate learning environment and close student-faculty interaction, with a student faculty ratio of 8:1. Students have access to an extraordinary resource: bright, accomplished, committed professors who are devoted to teaching and who choose to come to HMC so they can work with the nation's top undergraduate students.

Claremont Colleges Consortium

HMC is a member of The Claremont Colleges, a consortium of autonomous institutions, each of which excels in a particular academic niche. The consortium, which was modeled on the college system at Oxford University, consists of HMC and four other undergraduate colleges: Claremont McKenna College (government, business, and the professions), Pitzer College (interdisciplinary and intercultural exploration combined with social responsibility), Pomona College (comprehensive liberal arts and sciences), and Scripps College (educating women for the arts and professions). In addition, there are two graduate institutions: Claremont Graduate University (masters and doctoral education in a variety of fields) and Keck Graduate Institute (applied life sciences).

The Claremont University Consortium coordinates and supports the shared resources of The Claremont Colleges, such as the libraries and the campus bookstore, and also oversees the provision of health and counseling services, the mail system, campus safety, physical plant, and some intercollegiate student services. Each of The Claremont Colleges is independent and has its own campus, students, and faculty. All of the campuses except Keck are contiguous and within easy walking distance from one another. The consortial arrangement preserves the small-college experience for students and faculty members while providing them with the services and facilities of a mid-sized university.

HMC students benefit tremendously from the consortium. 100% of HMC students take at least one course away from their home college, interact closely through coursework and activities with students who have very different backgrounds and interests from their own, and enjoy the extensive facilities and cultural programming that the consortium affords. HMC faculty members also enjoy working with faculty colleagues at the other Claremont Colleges and participating in shared programs like our Center for Teaching and Learning.

I.III Students, Student Life, and Alumni

Admissions

From its earliest days, HMC has attracted students of extraordinary quality, and the class that entered in the Fall of 2017 continues this pattern. The 225 students in that class have median combined verbal and math SAT scores of 1470. Of the students whose high schools provide rank, 90% were in the top 10% of their senior class. Another indication of the high quality of our applicants is that the four institutions with which we have the greatest number of application overlaps are MIT, UC-Berkeley, Caltech, and Stanford. Over the last decade, the College made substantial progress in recruiting women, and they make up 52% of the incoming class. One quarter (25%) of the incoming class comes from minority groups which are historically underrepresented in STEM.

In the 2017-18 academic year, HMC has 844 full-time students, 52% of whom are female and 22% of whom identify as belonging to groups that are minoritized and historically underrepresented in STEM. Tuition, Room & Board and fees in 2017-18 are $74,428. Nearly three fourths (74%) of students receive financial aid; the average aid award is $38,572.

The quality of the students HMC admits is further demonstrated by the national recognition many of our students garner. For instance, a 2017 graduate received one of only two Apker Awards given annually by the American Physical Society for outstanding achievement in physics research by an undergraduate. Additionally HMC students and recent graduates have been honored as Astronaut Scholars and with Goldwater Scholarships, Watson Fellowships, Fulbright Scholarships, and NSF Graduate Fellowships. Under the encouragement and tutelage of their professors, many HMC students do exceptionally well in national and international competitions, including .the International Mathematical Modeling Contest, William Lowell Putnam Mathematical Competition, the Mathematical Contest in Modelling (MCM) and Interdisciplinary Contest in Modelling (ICM), and the ACM Regional International Collegiate Programming Contest.

Residential Life & Student Support

Students at HMC are part of a residential community that enjoys the responsibility and accountability of self-governance. First-year students are required to live on campus, and approximately 92% of the student body lives in one of our ten campus residence halls or apartments.

HMC's Honor Code establishes an environment of cooperation and mutual trust. By expecting all students to respect the individual rights and property of others, and to be responsible for their own actions in both the residential and academic setting, the student-directed Honor Code fosters trust among students and the faculty and facilitates student learning despite the demands of our curriculum.

To enhance students' learning and growth, HMC offers many programs, facilities, resources and support structures. HMC's Office of Learning Programs consists of two peer-tutoring programs, The Writing Center and Academic Excellence (AE). The Writing Center offers opportunities for students to work through the writing process and improve the expression of their ideas by participating in individualized conferences and occasional group workshops with trained peer consultants. In 2016-17, the writing center conducted 877 individual consultations with 336 unique clients. About 50% of all consultations were for Core courses—43% were for Introduction to Academic Writing (Writ 1 and Writ 1E) papers and 17% for HSA 10 papers. Roughly one third of the writing centers work was with writing in other courses, both

technical and non-technical. The remaining 5% were other writing projects, primarily application essays for graduate school admission and fellowships, resumes, and cover letters.

HMC's AE Program offers 10 semester-long tutoring workshops for (mostly) Core courses in math, chemistry, physics, biology, and engineering. Each AE workshop is guided by a team of student facilitators trained to teach problem solving and collaborative learning approaches, and are intended to provide opportunities for students to practice critical thinking and study strategies while working through their homework assignments in a collaborative setting. Math workshops meet four times each week. Chemistry, physics, biology, and engineering workshops meet two times a week on average, and all subjects hold additional meetings for exam reviews and other course-specific assistance. In the 2016-2017 academic year, AE workshops across all disciplines had nearly 1,300 student participants.

The Office of Institutional Diversity (OID) provides HMC with intentional programming to foster a diverse learning community and help develop the intercultural skills that students, faculty and staff need to succeed in our increasingly diverse environment. OID has engaged the College community in continued discussions about individual and group differences and how those differences strengthen our learning environment. Through its three-pronged mission of "awareness, allyship and action", OID is intentional in its development of programming, learning outcomes, and its support of the College's curriculum.

Students have many demands placed on them. Family expectations, academic pressure, social pressure, identity formation, adjusting to college and life events may outweigh some students' coping skills. HMC recognizes this and has its own emotional health counselor who supplements the support offerings available through the Claremont Consortium and acknowledges the differing needs of HMC students. The Office of Health and Wellness (OHW) engages in prevention and intervention efforts through individual, couples and group support meetings, and outreach efforts to students, faculty and staff. OHW also recognizes diversity as an essential element in its mission, and defines diversity globally to encompass marginalized groups in addition to racial and ethnic groups. Operating within an 8-dimensional model of wellness, OHW runs empirically-supported prevention and training campaigns based in the public health and clinical psychology fields.

The Associate Dean for Academic Affairs (ADA) reports to the Dean of the Faculty and has an important role with respect to the Core Curriculum. The ADA monitors academic workload and progress, especially for the Core, coordinates the first-year advising program, reviews and approves student overloads and incompletes, and oversees the Off-Campus Major, the Program of Transfer Studies, and the Individual Program of Studies. Additionally, the ADA serves on several committees relevant to students success and the Core. The ADA chairs the Academic Affairs Committee, and is a member of Curriculum Committee and the Scholarly Standing Committee.

Finally, our Office of Disability Resources (ODR) offers support to all students who engage in our curriculum. The office ensures the effective delivery of reasonable accommodations; promotes access through outreach and training for faculty, students and staff; supports students as they develop self-advocacy; and partners with faculty in creating inclusive learning environments based on the principles of universal design. These efforts promote a climate of inclusion and diversity in which differentially-abled students are included as integral contributors to our intellectual community. The ODR's efforts are strengthened through its partnership with the recently established five-college Student Disability Resource Center.

Together these programs and services work together to provide a backbone of support for our community.

Co-Curricular Opportunities

While the academic workload is heavy compared to many other liberal arts programs, most HMC students participate in a variety of co-curricular activities available at The Claremont Colleges. There are twenty academic and professional organizations, over one hundred activity clubs, and a dozen sports clubs. Together, these organizations and clubs respond to many individual needs: spiritual, political, cultural, social, physical, emotional, and professional. The Claremont University Consortium is the home of the Office of Black Student Affairs, Chicano/Latino Student Affairs, the Queer Resource Center, the Chaplaincy, and Health Education Outreach. All of these services offer activities of particular interest to HMC students.

Trustees, faculty, and staff genuinely value collaborating with students on the work of the College. To facilitate this cooperation, representatives of the student government—the Associated Students of Harvey Mudd College (ASHMC)—sit as *ex officio* members on most trustee and faculty committees, including the Board of Trustees.

The College shares an NCAA Division III intercollegiate athletic program with Claremont McKenna and Scripps. Housed at Claremont McKenna College, and known as CMS, the program offers nineteen varsity sports and competes in the Southern California Intercollegiate Athletic Conference. CMS also offers HMC students an extensive physical education and a popular intramural program.

Alumni

HMC has a loyal, active, and dedicated base of nearly 7,000 alumni. The founding HMC class graduated in 1961 and the alumni association was created in 1965. The Alumni Association Board of Governors (AABoG) comprises 21 governors serving staggered three-year terms elected by all the alumni. It meets four times a year and is organized around eight committees. Most committees are open to all alumni and each committee has a monthly conference call to coordinate its work. Some of the committees are organized around projects, such as the annual Alumni Weekend, which attracted nearly 1,000 attendees last year, or other events, such as the solar eclipse last August when four alumni events were held in the path of totality from Oregon to South Carolina, which in total attracted nearly 600 attendees. Some of the committees are organized functionally to help the College, such as in fundraising to help the College's Advancement Office, or finding alumni to work admission events around the country when the College's Admission Office cannot staff an event. Although almost half the Board of Trustees are alumni, there are two special trustee positions for alumni: an Alumni Association representative, usually the past president of the Alumni Association, serves a two-year term and a young alumni, less than 10 years from graduation, serves a three-year term.

The Office of Career Services provides extensive assistance to students, both during their College years as they explore professional opportunities through summer research and internships, and upon graduation as they plan for careers. Faculty advisors work closely with students who wish to pursue graduate study and offer pre-professional support for students with aspirations in medicine and education. Many HMC alumni head directly to graduate and professional programs. For the class of 2017, 28% expected to enter graduate school in the fall. Another 49% had accepted offers to work in industry, with an average starting salary of $89,942. The remainder of 2017 graduates indicated their plans included travel, pursuit of fellowships like the Watson, or postponement of specific commitments.

The oldest graduates of HMC are now in their early to mid 70s, and they are relatively few in number. Still, these alumni have made substantial and recognized contributions in many realms. In particular, graduates of all generations have developed a reputation, both in industry and at graduate schools, as

premium problem solvers with a broad education that allows them to excel in virtually any field they enter. While the majority of graduates have remained in engineering and the sciences, HMC has also produced more than its share of CEOs, CFOs, entrepreneurs, attorneys, physicians, financial specialists, and the occasional astronaut, missionary, film producer, and ambassador.

I.IV Finances and Institutional Advancement

Endowment and Budget

HMC has a history of financial strength and stability. As of June 30, 2016, it reported an endowment market value of $272,635,872. The endowment-per-student is $357,226. The College's operating budget for 2016-17 was $35 million.

I.V Challenges

As HMC looks to the future, it faces the challenges of a maturing, growing, and highly successful institution as it adapts to the new dynamics of American higher education. To remain true to the social component of its mission, HMC is working to diversify its faculty and student body in a very competitive segment of the educational market. HMC must maintain its emphasis on academic excellence in order to enhance and raise its national profile. As other institutions adopt the combination of theoretical and practical education that has been the hallmark of an HMC education, HMC must find new ways to differentiate itself while not abandoning or compromising its core values. At the same time, it must find new resources to enable continued innovation in the curriculum; sustained attention to the quality of academic and student facilities and spaces for teaching, learning, and living; increased student involvement in research; and the recruitment of the very best faculty and students. These challenges are real and difficult.

A related and fundamental challenge is to increase the College's resources through greatly increasing the endowment and locating new sources of support, necessary to undergird the diversification and inclusiveness of our community. The education HMC offers—with its hallmark low student-faculty ratio, small student body, and the equipment and space necessary for research in the STEM disciplines—is expensive by its very nature. Given our small size and relative youth, its alumni base is limited and does not yet provide the support to the College that it will a decade or two in the future. In the next ten years, then, the College must build an endowment that will ensure the continued operation of HMC's innovative programs on a par with the top colleges and research institutes in the country.

II. Our Process

In 2016-17 HMC, like many other colleges across the country, experienced tumult on campus surrounding issues of workload, student identity, and how different identities may intersect with success at the College. Issues of race, equity, and access were prominent in our discussions. The situation in the spring became so acute that the faculty took the unprecedented step of canceling two days of classes near the end of the semester so that the community had time to "reset", reflect, and individuals had time to talk to each other. Discussions of possible revision of the Core have been on-going at HMC for the last two years, and while we have made some progress in making changes, most of these changes have been incremental and the faculty have not been able to make substantial progress in the discussions. The events of the spring made it clear that the Core is a point of tension for many students and that a more focused and fruitful discussion of Core revisions is needed.

Within this context, we undertook an examination of our Core. The Core Review Planning Team (CRPT) spent the summer and fall developing the studies, presentations, formal communications, and conversations which have led to this document.

As we prepared for this external review of our Core, our charge has been to keep the community informed of our actions and progress, to facilitate data-driven discussions about the Core across all College constituencies, and to collect feedback from those constituencies. We have acted in as transparent and communicative fashion as possible: we have included students, staff, faculty and alumni on the CRPT; since the beginning of the summer, we have sent monthly updates to the entire community explaining what the CRPT has been doing; we have had monthly meetings throughout the fall with both the faculty and the broader HMC community (faculty, students, staff, alumni) at which we have presented portions of the data that we have collected and have asked the attendees to discuss it; we have made no judgement regarding how or if our Core should change in the future, and have provided venues for people to meet and discuss data we believe is relevant to our discussions; and we have been intentional in collecting feedback from the faculty and larger community after each meeting so that we can more effectively facilitate our future conversations. Further, through this time, we have been in contact with consultants at Caltech (see below) who have given us feedback on our plans, helped us brainstorm, and provided wise advice. We have done all of this in the hope that, come December, the faculty, informed by its own discussions and those of the broader HMC community, can vote on a statement of goals for the Core– something akin to a mission statement for our Core. Given our inclusive process, we expect that this statement will have broad buy-in from the faculty and the wider HMC community. We hope that a statement of Core goals will allow us to pivot in the spring to a discussion of whether and how we should revise our Core.

Our fall-semester meeting schedule for the faculty and the broader community is shown below. Note that most faculty meetings are mirrored by a community meeting at which whatever data was presented to the faculty was also presented to the community. We have used every unscheduled Thursday (our traditional weekday for faculty meetings) in the fall semester to meet with the HMC faculty.

September 7 (part of a faculty meeting): Introduce the CRPT, describe our summer efforts, and relay our plans for the fall process

September 14 (faculty meeting): Discuss results of surveys that were administered to the faculty, students, staff, and alumni

September 15 (community meeting): Discuss results of surveys that were administered to the faculty, students, staff, and alumni

October 19 (faculty meeting): Discuss data regarding student struggles in the Core as relates to gender, race, and high school preparation.

October 20 (community meeting): Discuss data regarding student struggles in the Core as relates to gender, race, and high school preparation. Further discuss survey results regarding workload in the Core Curriculum.

October 26 (faculty meeting): Discuss survey results regarding workload in the Core Curriculum.

November 9 (faculty meeting): Present strawman proposals for a statement of Goals of the Core Curriculum.

November 10 (community meeting): Present strawman proposals for a statement of Goals of the Core Curriculum.

November 13-15: External review of the Core Curriculum.

November 30 (faculty meeting): Discuss and finalize strawman proposals for a statement of Goals of the Core Curriculum.

December 7: Possible vote by the faculty on a statement of Goals of the Core Curriculum.

As mentioned above, another facet of the CRPT's process has been to engage external consultants to share knowledge and give advice as we engage in the Core review. We have been in contact with Dr. Cassandra Horii and Dr. Jenn Weaver at Caltech's Center for Teaching, Learning & Outreach. They have helped us to develop a review process that included faculty, students, alumni, and staff, to think through the structure of our faculty and community meetings, and to always stay focused on the possibility of developing a statement of goals for the Core that the faculty can approve and that the community had a voice in creating. Drs. Horii and Weaver have agreed to lead a strategic planning session in January 2018 that will be designed to help us pivot from a statement of goals of the Core to development and implementation of Core revisions. (This pivot is conditioned on the faculty coming to a successful vote in December.)

III. Perspectives on the Core

The Current Core

The Core at HMC provides students with common foundations in the STEM fields as well as a course in writing and one in critical inquiry. As shown in Table 1, the Core comprises the following:

- One semester each in biology, computer science and engineering
- Three semesters of mathematics
- Two and a half semesters of physics and an associated laboratory
- One and a half semesters of chemistry and an associated laboratory
- A half-semester biology laboratory
- A half-semester of college writing
- A course in critical inquiry offered by the Department of Humanities, Social Sciences, and the Arts

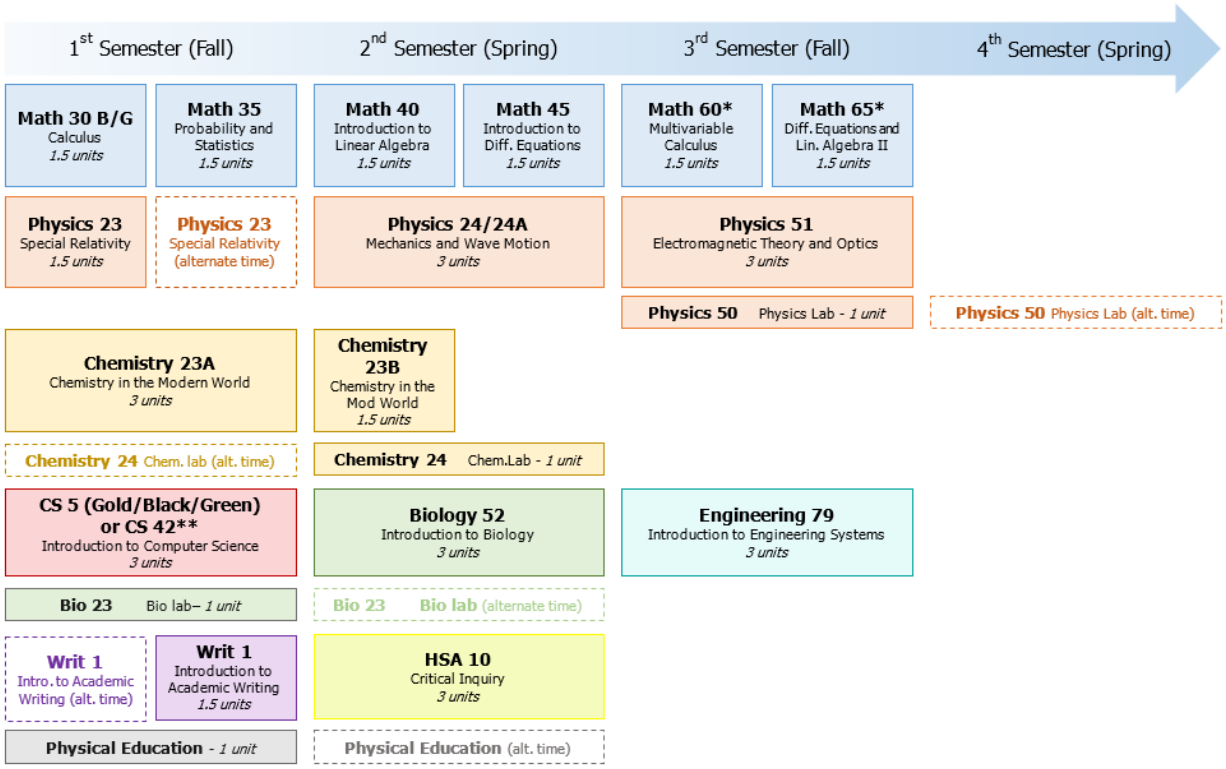

*Table 1. A map of the Core. This table shows a rough approximation of a student's schedule in their first four semesters at the College. To reach the 128 credit graduation requirement, a student must complete an average of 16 units per semester. * Math 60 and Math 65 may also be completed in the summer following a student's second semester; ** Students with extensive prior knowledge of computer science may opt to take CS 42: Principles and Practices of Computer Science instead of a CS 5 course.*

Some salient features of the Core are:

- Most Core courses are taken at the same time by all students. The intent of this synchrony is to build and nurture a learning community and to provide tools and problem-solving skills that form a common language among students. There is some variation due to students who may have sufficient background to place out of a course, and the Engineering core course (Engineering 79, Systems Engineering) is generally taken in the sophomore year but some non-majors choose to take it in the junior year.

- Some courses have multiple versions (sometimes called "Gold" and "Black" because those are the College's colors) - the "Gold" version is for students with regular background and the "Black" version is for students with more background. The intent is to provide the right level of challenge and a supportive learning environment for all students.

- While many students complete the Core by the end of the third semester, every Core course must be attempted by the end of the fifth semester.

III.I Faculty, Staff, Student, and Alumni Views on the Core

As part of the surveys that were administered to all College constituencies (faculty & staff, students, and alumni) in the late summer and early fall, we asked respondents to rank in order of importance a list of

seven themes which recur in our discussions of the Core (see Appendix 1 for the questions that appeared on the surveys). These themes were generated by external consultants from Caltech who spent a day on our campus interviewing people to try to better understand how the community viewed the purpose and function of our Core. They provided us with a report (Appendix 2) which suggested, among other things, that the community views the function and purpose of the Core as being described by seven broad themes:

- Inspiring in students a sense of curiosity and excitement about what is possible in a discipline
- Building interdisciplinary facility (e.g., equipping students to engage across disciplinary boundaries)
- Providing a "technical toolkit" that acts as a foundation for advanced study in STEM
- Learning a little bit about a wide range of STEM disciplines
- Helping students discover what they are capable of intellectually and technically
- Helping students learn to work efficiently and productively
- Helping students choose a major

The external consultants noted that while these were recurring themes in their conversations about the Core, they were not discussed with either a sense of prioritization or general agreement on their relative importance. One of the purposes of our surveys was to have the College's various constituencies rank-order these themes.

The response rates to the surveys were relatively high: 73% for faculty, 9% for staff, 60% for students, and 25% for alumni. The results—coming from over 2,000 individuals—for the prioritization items are shown in Figure 1. The results are unexpected and delightful: all constituencies converged on three priorities, the first three themes listed above:

(i) Inspiring in students a sense of curiosity and excitement about what is possible in a discipline

(ii) Building interdisciplinary facility (e.g., equipping students to engage across disciplinary boundaries)

(iii) Providing a "technical toolkit" that acts as a foundation for advanced study in STEM

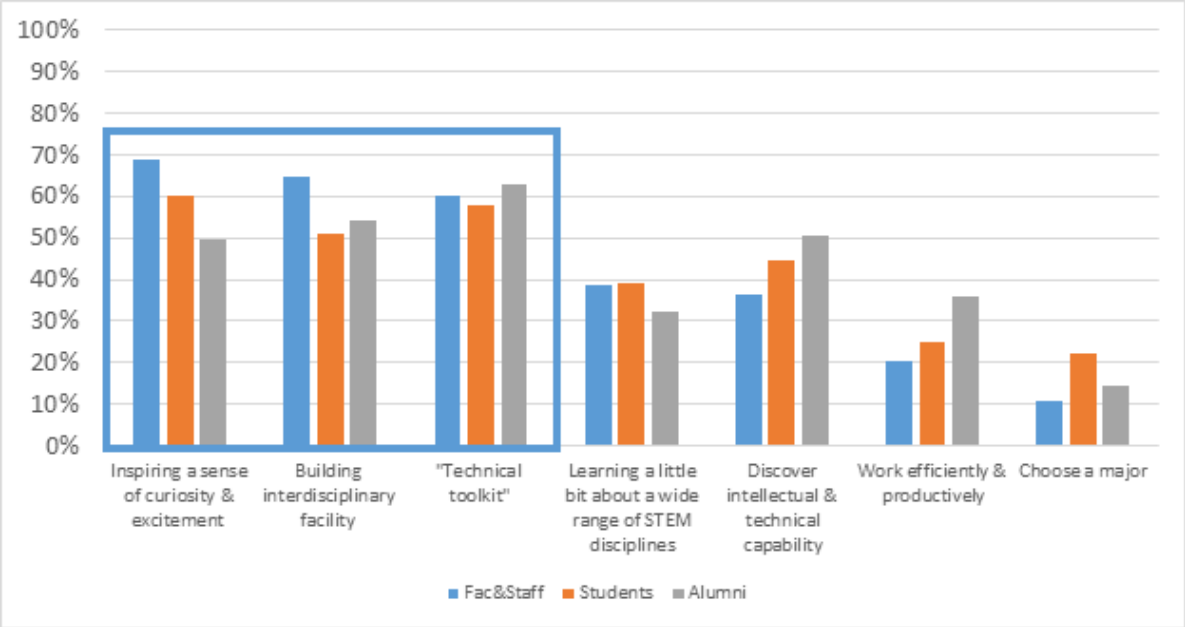

Figure 1. We asked survey respondents to rank the importance of themes prevalent in describing the purpose of the Core Curriculum. This figure shows the percent of each constituency that ranked each item in their top three priorities. We were pleasantly surprised to see that here is convergence onto three priorities.

At a special meeting for faculty, and a subsequent meeting for all members of the community, we asked "What's missing from these three high consensus items?" While we heard a number of important ideas, the three most common responses were:

> (i) We're trying to do too much in the Core. The three goals are so broad that they invite the possibility of another "firehose" Core (i.e., because of the large volume of material presented in the Core, some students and alumni have likened the experience to "drinking from a firehose").
>
> (ii) Impact of the work on society and social engagement. This is in the College's mission statement but doesn't emerge as one of the three pillars here.
>
> (iii) Constructing a Core that is inclusive and supportive of all students.

It also became evident that the "technical toolkit" was interpreted in several different ways including a set of specific technical skills that students acquire to a broader interpretation that includes higher-level skills such as problem-solving, communication, etc. These three responses, then, give us some constraints and cautions as we consider the possibility of revising our Core. In addition, we conducted a "gap analysis" that looks at the differences between what respondents think that the Core is currently doing versus what it should be doing. The results of that analysis are included in Appendix 3.

III.II Departmental Perspectives on the Core

In addition to soliciting input from individuals, we sought to learn how each department views the role of its Core courses and their values for a future Core. The survey questions are in Appendix 4. This section synthesizes the responses from the departments.

Conveying Big Ideas from Our Disciplines: All departments indicated that this should be a high priority in the Core but that the need to deliver content sometimes leaves insufficient time to convey the big and beautiful ideas. Mathematics, in particular, has a large service role in the core and the three-semester math footprint in the Core means that the material is often presented in a "fast and furious" fashion, leaving little time to expose students to big ideas and a broad view of mathematical thinking.

Departmental Interdependencies and the Core: What follows is a summary of the most basic dependencies that departments indicated in their surveys. Some high-level dependencies, notably the good writing and oral communication skills taught in Writ 1 and HSA 10, are not included below since it is widely accepted that every HMC student must have these skills. Moreover, while departments frequently expressed appreciation for the high-level problem-solving skills that are provided throughout the Core, these are not included in the nuts-and-bolts dependencies listed below.

- Biology relies on CS 5 (Intro CS) and Math 35 (Probability and Statistics) for its own Core course, Biology 52, which is taken in the spring of the first year. The Biology major depends on Core chemistry, probability and statistics, and introductory CS.

- The Chemistry Core relies on Core mathematics (multivariable calculus and differential equations). The Chemistry major also relies on linear algebra, biology for our biochemistry requirement, and concepts from the Physics Core (particularly mechanics and electricity and magnetism).

- The Computer Science Core course (CS 5 or CS 42) is taken in the fall of the first year and thus cannot rely on topics from the other Core courses. However, CS 5 seeks to make connections to the material being taught concurrently in the other Core courses. The Computer Science major depends on mathematical maturity developed in the math Core and on the content taught in linear algebra.

- Engineering relies on the Core math for its own Core course (Engineering 79) and content from all of the other departments for its major. CS 5 generally does not provide enough computational training for engineering majors and thus many engineers take CS 60 and CS 70 as well.

- Humanities, Social Sciences, and the Arts offers HSA 10, which is fundamentally dependent on the skills acquired in Writ 1.

- Physics relies very heavily on Core math for its own Core courses and for its major. Some topics in the Chemistry Core are used in the Physics major. Engineering 79 serves as an important complement to a Physics Core lab and also useful for Physics majors.

What More (or Less) is Needed?

Several departments, notably Chemistry and Physics, express that they struggle with the high level of variation in student background. For Chemistry, that background is high school chemistry. For Physics, it is largely gaps and lack of facility with mathematical foundations.

Several departments indicated that they depend on more probability and statistics than is currently taught in the Math 35 Core half course. Some departments also note that by the time that linear algebra or differential equations is used in their upper-division courses, students aren't able to access that background as readily as is expected. There are also some sequencing issues that cause some departments to teach the math that they need in their Core courses because its presentation in the math Core comes later.

Some departments indicated that the Core Computer Science courses do not provide sufficient computational background for their majors and thus their majors are encouraged to take one or two additional Computer Science courses.

Many departments indicated that societal issues and the impact of our work on society do not get sufficient attention in the Core.

IV. Preparation, Performance and Challenges in the Core Curriculum

Coming out of our tumultuous 2016-2017 academic year, the CRPT spent considerable time gathering data about student success in the Core. We focused our efforts on how student success in the Core (as

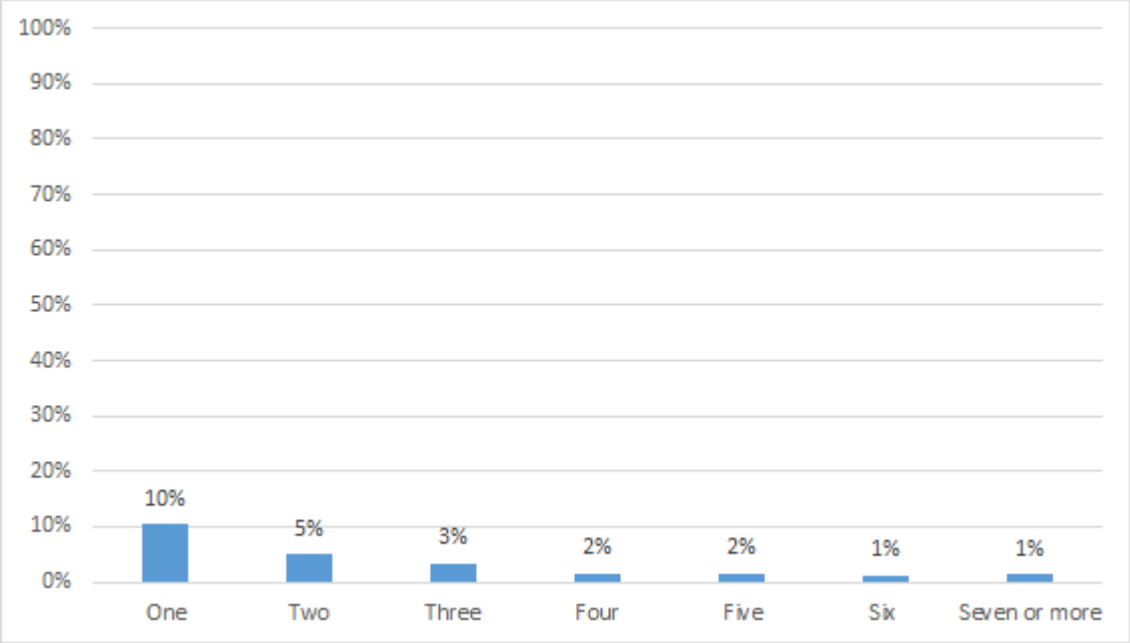

Figure 2. The percentage of HMC students who struggled in the Core Curriculum between 2010 and 2016. The horizontal axis denotes the percentage of students who struggled in exactly one course, exactly two courses, etc. The total fraction of students who struggled in our Core is 24%.

measured by GPA) was related to students' high-school preparation, sex, and minority status, as these parameters were the focus of much of the community conversation in the spring of 2017. The summary of our findings—we go into more detail below—is that a student's sex had essentially no bearing on success in the Core, and that together status as a STEM underrepresented minority and high-school preparation explained only a tiny fraction of the variation in students' success in the Core. This result was surprising to our faculty, but, within the parameters of our study, it is consistent across all courses. This leaves unknown the factors that explain the vast majority of the variation in our students' performance in our Core.

Figure 2 shows that approximately one-quarter of the students at HMC struggle in our Core. The data was gathered for students in the Core between 2010 and 2016. We define "struggle" as receiving a grade of NC (no credit), F, D, or D^+ in a course. We see that while a total of 342 out of 1426 students struggled in our Core over this period of time, 10% of all students struggled in exactly one course, 5% of all students struggled in exactly two courses, etc. Figure 3 shows how student struggle is disseminated across

Core courses. The height of the bar denotes how many students took a particular course; the red portion shows how many of those students struggled in the course, and the blue portion shows how many students did not struggle.

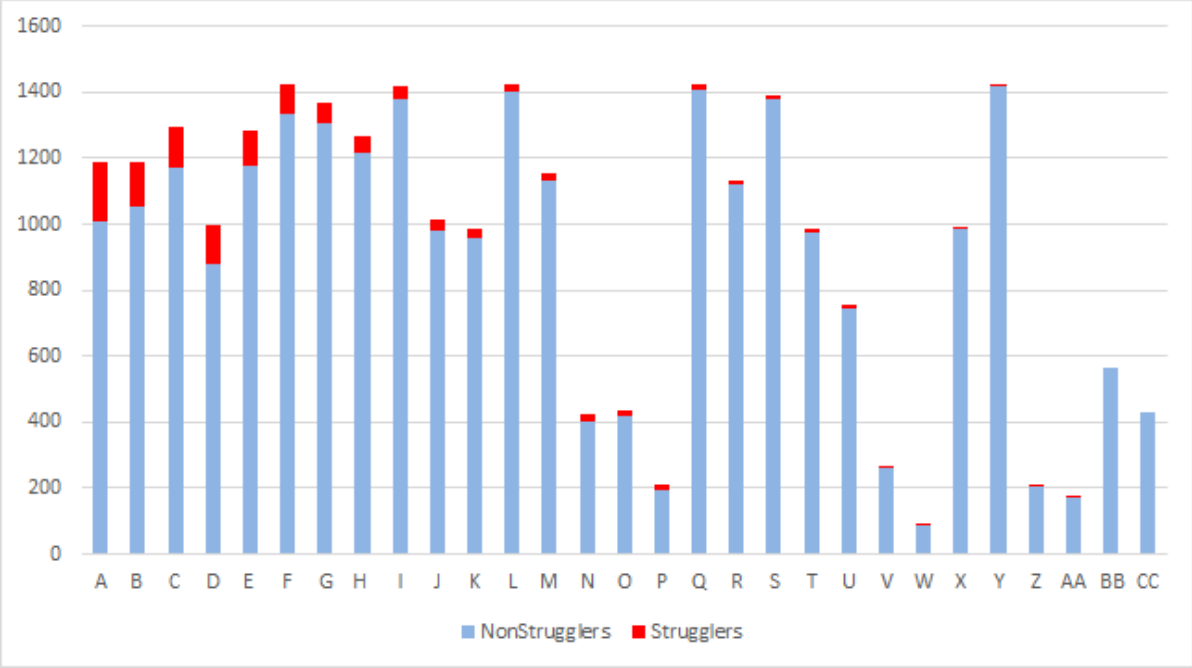

Figure 3. Students' struggles in the Core Curriculum as broken out by course. Courses in the Core are listed A-CC. The bars indicate the total number of students who took a particular course between 2010 and 2016; the top red portion of the bar represents the students who struggled in a course, the bottom blue portion represents those who did not struggle.

Figure 4 shows how struggles in the Core broke out by a student's sex when we consider the 148 students who struggled in exactly one Core course between 2010 and 2016. The fraction of students of a particular sex in the student body is shown by the orange bars, while the yellow bars represent the fraction of strugglers which are represented by each sex. A gratifying result is that there is no statistically significant difference between the sexes when we look at students struggling in one course, or those who struggle in 2-4 courses. Only when we consider the extreme case of students who struggled in 5 or more courses (~50 students over the time of the study) do we find a statistically significant difference, and even then the result just crosses the threshold of statistical significance ($p = 0.0497$).

The take-home message for the "sex vs. performance in the Core Curriculum" data set is that male and female students experience the same amount of struggle (as defined above) in the Core.

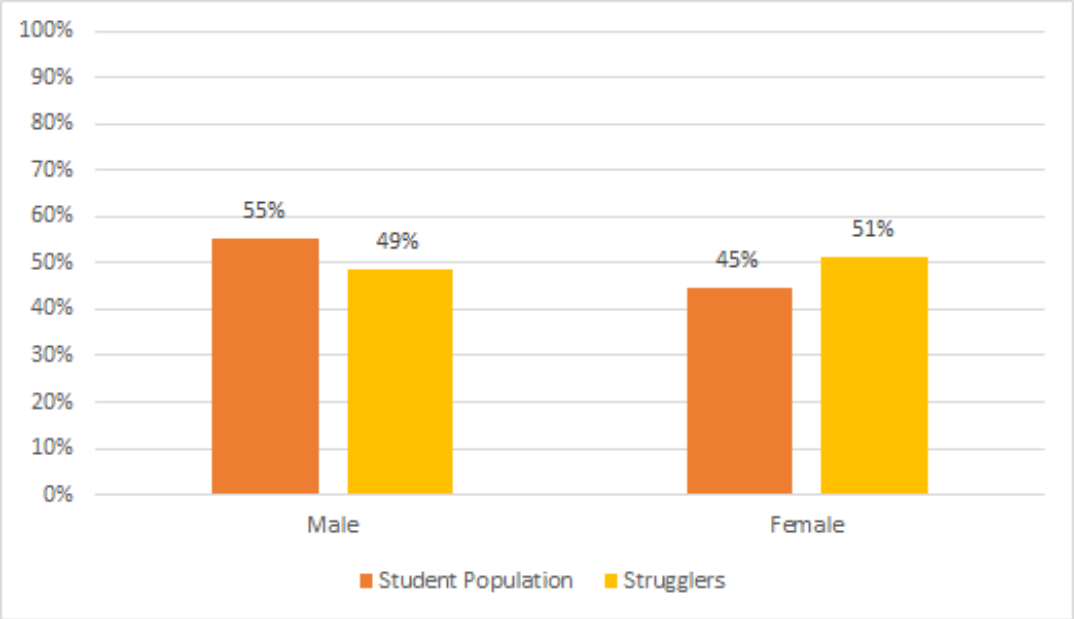

Figure 4. Students' struggles in the Core between 2010 and 2016 as compared by sex. The orange bars represent the fraction of the student population each sex represents, and the yellow bar shows what fraction of the strugglers each sex represents. This figure shows the data for the group of students who struggled in exactly one Core course (148 students). There is no statistically significant difference between the sexes.

While it is satisfying to know that struggles in our Core are not associated with a student's sex, we are also interested to know if race or high-school background have any relationship with success in our Core. Figure 5 shows the adjusted-R^2 values for a regression that asks how much of the variation in performance in a particular Core course is accounted for by a student's race, high-school preparation, and the combination of the two. For our study, "race" includes the following categories: white, historically underrepresented minority groups in STEM (African American, Hispanic, Native American, Pacific Islander), Asian, international students, and other (multi-racial, or unknown race). The R^2 values are shown for graded courses in the Core (10 courses were examined, 7 had significant regressions). For the analysis shown in Figure 5, we used data from the 2014 and 2015 entering cohorts in the math, chemistry, and physics departments, and we only include in the figure graded Core courses which have statistical significance to their results.

What we learn from Figure 5 is that, for example, in Course B 9% of the variation in students' success is explained by the combination of a student's race and high-school preparation. For this particular course, high-school preparation has more impact than race, but this is not true of all the courses shown.

There are two notable points in Figure 5. The first is that the combination of the R^2 value for race and the R^2 value for high-school preparation do not add up to the R^2 value for the combination of the two. This is because race and high-school preparation are not independent. The second notable point is that in no course do the combined effects of race and high-school preparation account for more than 17% of the variation we see in students' grades. For many of us, this is a surprising result. Much of the campus conversation over the last year has revolved around the intersection of our Core with a student's race and high-school preparation (thus, this particular analysis was carried out), however, Figure 5 suggests that other unexplored factors are cumulatively much more important to a student's success in our Core.

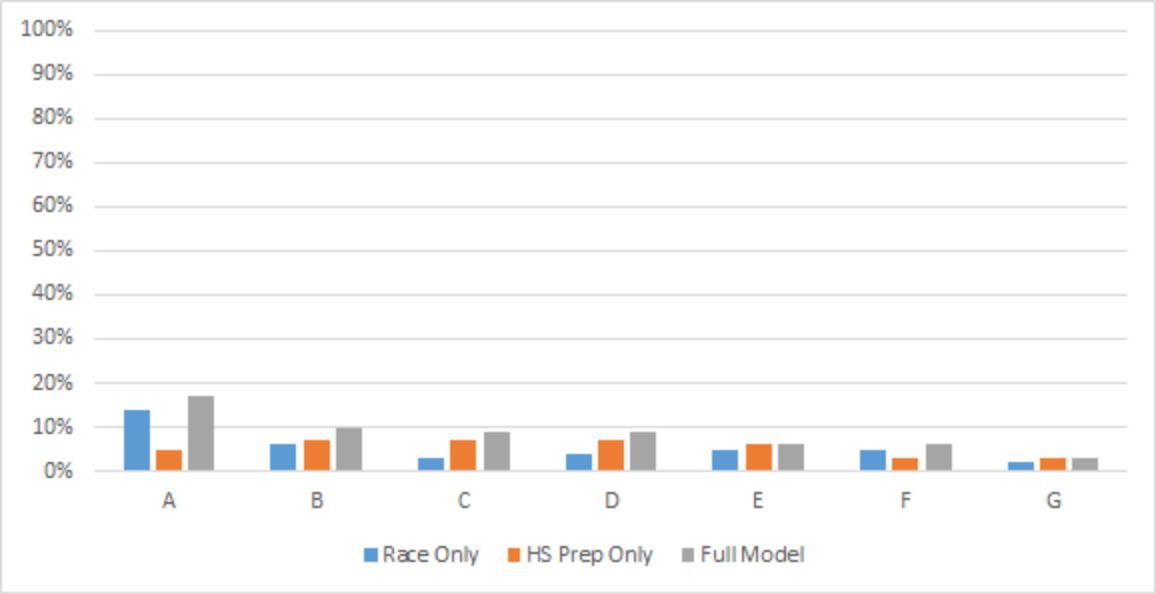

Figure 5. The adjusted-R^2 results of a regression relating students' success in a particular Core course to their race and high school preparation. Courses are listed A-G. The R^2 value in this case describes how much of the variation in students' grades in a Core course is accounted for by a particular attribute. Blue bars show the R^2 value when correlating course grade with only race; orange bars show the R^2 value when correlating course grade with only high-school preparation;grey bars show the R^2 value when correlating course grade with both race and high-school preparation.

When the faculty and community were presented with the data outlined in this section we prompted them with the following question:

Do these data impact your view of what the goals of our Core should be? If so, in what way?

The responses we received from this prompt fell largely into four categories:

- Some people thought that the rate of struggling (as we defined it) was low and/or normal whereas others were alarmed by it and felt that the threshold for struggling was actually very low and that many more students are probably struggling than indicated by these data. [This response comes, in part, because all of our students earned excellent grades in high school, so even a B or C in a Harvey Mudd course can make the student feel like they have been struggling.]

- Some people wanted more data and different analyses, but some also noted more data might be helpful in specific courses but not in formulating the objectives or design of the Core.

- The struggles that students confront at Harvey Mudd may not be measurable or quantifiable; they may not have as much to do with grades as they do with emotional or personal well-being.

- A number of respondents indicated that the Core should provide a common set of foundations, but that the path to achieving that should be more flexible.

V. Workload

In addition to the impact of sex, race, or high-school preparation on a student's experience in the Core, the CRPT tried to better understand how students experience the workload of the Core. We first compared our Core to that of other institutions and found that the most salient comparisons were with MIT and Caltech. A summary is shown in Table 2.

	Math	Phys	Chem	Bio	Eng	CS	Labs	HSA	Writing	Tech Elective	Total
Caltech	1.00	1.00	0.67	0.33	--	--	0.67	0.67	0.22	0.33	**4.9**
MIT	1.00	1.00	0.50	0.50	--	--	0.50	1.00	--	1.00	**5.5**
HMC	1.50	1.25	0.75	0.50	0.50	0.50	1.50	0.5	0.25	--	**7.3**

Table 2. A comparison of Core Curricula at Harvey Mudd, MIT, and Caltech. Each number represents the required number of years of study. CalTech's Core runs for 1 year, MIT's for 2 years, and HMC's for 1.5 years.

Harvey Mudd, Caltech, and MIT have varying additional physical education and humanities, social sciences, and art requirements. Although these are requirements to graduate, in this summary, we have only focused on the Core Curriculums.

Three 10-week terms at Caltech are roughly equivalent to two semesters at either MIT or HMC – each is an academic year. To simplify comparisons, the technical Core requirements are represented as fractions of an average academic year in Table 2.

The Core Curriculum at Caltech has three terms of math, three terms of physics, two terms of chemistry, one term of chemistry lab, one term of biology, one term of a lab from a menu, and one term of a technical course to be selected from a menu. Students at Caltech average about five full courses per term to graduate in four years, depending on their major.

The Core at MIT has two semesters of math, two semesters of physics, one semester of chemistry, one semester of biology, one lab subject, and two "restricted electives" in science and technology. Students at MIT average about four full courses per semester to graduate in four years, depending on their major.

The Core at HMC has three semesters of math, two-and-a-half semesters of physics, one semester of physics lab, one-and-a-half semesters of chemistry, one semester of chemistry lab, one semester of biology, one semester of biology lab, one semester of engineering, and one semester of computer science. Students at HMC average slightly more than five full courses per semester to graduate in four years.

Except for the technical elective, HMC's Core requires more study in each subject than either Caltech or MIT.

Some of the student-survey results related to the issue of workload in the Core and are shown in Figure 6. Students were asked, "How often during the semester did you have enough time to pursue interests outside of the class and homework?" This question was asked in reference to each of the first three semesters of the Core. Responses for the second semester, generally considered the toughest because of a high course load and because it is the first graded semester, are shown below. The responses to this question for the first and third semester are similarly distributed, but peak around "Sometimes". What the optimal distribution of responses is to this prompt remains an open question.

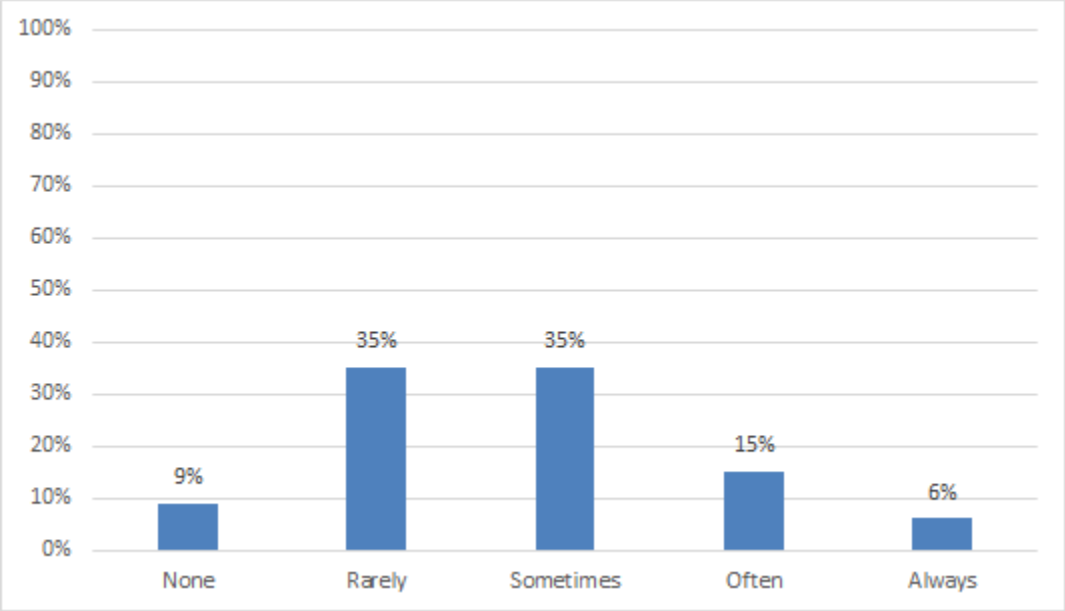

Figure 6. Responses to a student-survey question: "How often during the second semester did you have enough time to pursue interests outside of the class and homework?"

In the survey, we also asked students to rate each Core course they took with respect to effort and learning. Students placed each course into one of four categories: high-effort/low-learning; high-effort/high-learning; low-effort/low-learning; low-effort/high-learning. Once again looking at the second semester, Figure 7 shows which category had the highest percentage of responses. For example, 42% of respondents ranked course "F" as "high-effort/high-learning"; each of the other three categories had less than 42% of respondents for this course. No judgement is offered at to whether "high effort" is a good or bad descriptor compared to "low effort", although clearly "high learning" is preferred to "low learning."

We have collected similar data for the first and third semester, and the results are similar for the entire Core: the vast majority of courses fall in the "high-effort" category, either "high-learning" or "low-learning". This result suggests that our students perceive a significant course-related workload in our Core, a suggestion which is amplified by the comparison of our Core Curriculum to that of other institutions (see Table 2).

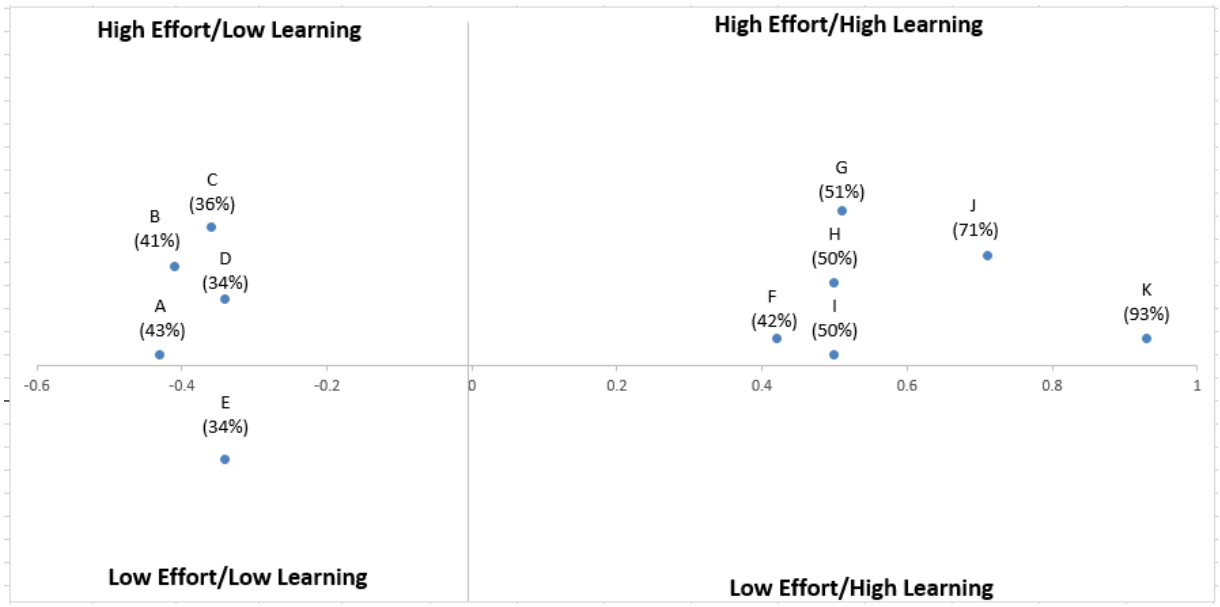

Figure 7. On a survey administered in the early fall, students were asked to place each Core course they took into one of four categories: high-effort/low-learning; high-effort/high-learning; low-effort/low-learning; low-effort/high-learning. Plotted in this figure is the entry which had the highest percentage of responses for each course in the second semester.

(As an aside, it is worth noting that this fall the College is undertaking a time-use study [called Workload and Health at Mudd, or WHAM!] that we hope will tell us more about how students use their time at Mudd, including while in the Core.)

When the faculty and community were presented with the data outlined in this section we prompted them with the following question:

Should workload be a design principle for the Core? If so, how do we regulate it across courses?

The themes in the responses we received from this prompt are summarized as:

- We should regulate workload across the core.
- Are we designing courses (the Core) for the mean of the workload distribution or for the tails of the distribution? The mean is easier to design for, but the tails are where the struggle occurs. We need to provide help to the outliers.
- Collect anonymous workload data in real time.
- What is the definition of a credit hour in terms of total time spent on a class? There seems to be a wide variation among students and among courses.
- Some issues that make workload regulation difficult:

  -Can we force a faculty member to assign less work?

  -Is a uniform workload equitable when students come in with different prior experiences?

-Who/what agent acts as the regulator of workload? (the Dean, a faculty committee, Core teaching pods, …?)

-It is resource intensive to support students who are outliers in a course.

-Why are some students outliers?

-If we take things out of our Core courses, departments may need more units to prepare majors.

If we do decide to move forward with revisions to the Core, these themes will give the faculty and the community much to consider.

VI. Our Mandate to the Reviewers

As the external review team, we hope that you can help us in our examination of the Core. In particular, after reading this document and meeting the community in November, we ask you to focus on answering the following questions:

- How well do we address in our current Core each of the three priorities converged on in our surveys?

  (i) Inspiring in students a sense of curiosity and excitement about what is possible in a discipline

  (ii) Building interdisciplinary facility (e.g., equipping students to engage across disciplinary boundaries)

  (iii) Providing a "technical toolkit" that acts as a foundation for advanced study in STEM

- Do you see obstacles (or enablers) for each of those priorities in the current Core?

- If we move to a revision of the Core, how might we address the following questions while constructing a curriculum:

  (i) Are we trying to do too much in the Core?

  (ii) The College's Mission Statement calls us to provide students "a clear understanding of the impact of their work on society", but do we address this in the Core? Shoulds we address this in the Core?

  (iii) Can we construct a Core that is inclusive and supportive of all students?

- Given the data presented in this document, do you see important issues missing from our analysis and discussion? Are there major topics we have missed entirely?

- How can we best move the faculty and broader community forward in an implementation process if we decide to revise our Core?

VII. Where are We Now?

Given the extensive surveys, data collection, and discussion that have occurred this summer and fall, we hope that the faculty can approve a statement of goals for the Core this December. The community has lacked a clear, guiding statement of this sort in the past and, as a result, recent discussions of our Core Curriculum have been difficult and made only halting progress.

The spring semester will bring us either the opportunity to move from a faculty-approved statement of goals for the Core to a discussion of revision of our Core, or, should the faculty be unable to approve a statement, it will bring us back to the job of achieving a community and faculty consensus about those goals.

CRPT Survey 2017-Students

Instructions

Harvey Mudd College has initiated a review of its Core Curriculum. The Core Review Planning Team (CRPT) seeks to understand the impact of the Core Curriculum on various campus constituencies and, as part of this process, we are asking sophomores, juniors and seniors to complete the following survey.

It should take about fifteen minutes to complete this survey. Your participation is voluntary and your responses confidential. Those with permission or authority to see the information in the survey will maintain its confidentiality to the extent permitted and required by laws and college policies.

If you have questions about this survey and how the results will be used in the Core review, you may contact Dr. Laura Palucki Blake, Director of Institutional Research and Effectiveness at lpblake@hmc.edu.

End of Block

Experience in Core

These questions ask you about the Common Core Curriculum ("the Core"). The Core means different things to different people, however for the purposes of this survey, it should be understood as:

The coordinated, common foundation (found in the early semesters of an HMC education) which blends the STEM disciplines—math, physics, chemistry, biology, computer science and engineering—as well as including classes in writing and critical inquiry.

Because the Core has evolved over time and different students are in different places with respect to the Core, not all the response options will apply to everyone. Please choose the options that best describe your experience.

Q3 **Please indicate the extent to which the items in this list were part of your community experience in the Core:**

	Never (0)	Rarely (1)	Sometimes (2)	Often (3)
Sharing a common experience with my classmates (Q3_1)	○	○	○	○
Sharing a common experience with all Mudders (Q3_2)	○	○	○	○
Meeting and/or learning about people different than me (Q3_3)	○	○	○	○
Developing a sense of belonging to a STEM community (Q3_4)	○	○	○	○

Q4 **Please indicate the extent to which the items in this list were part of your ethics and leadership development in the Core:**

	Never (0)	Rarely (1)	Sometimes (2)	Often (3)
Developing leadership skills (Q4_1)	○	○	○	○
Understanding the impact of scientific work on society (Q4_2)	○	○	○	○
Understanding the moral and ethical implications underlying my work (Q4_3)	○	○	○	○

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Q5 **Please indicate the extent to which the items in this list were part of your technical development in the Core:**

	Never (0)	Rarely (1)	Sometimes (2)	Often (3)
Exposure to a wide range of STEM disciplines (Q5_1)	○	○	○	○
Learning more than just "the basics" in a wide array of STEM disciplines (Q3_2)	○	○	○	○
Building a "technical toolkit" that is a foundation for more advanced study in STEM (Q5_3)	○	○	○	○
Preparing for study in your choice of major (Q5_4)	○	○	○	○
Learning to cross disciplinary boundaries (Q5_5)	○	○	○	○
Covering a lot of content (Q5_6)	○	○	○	○
Developing writing skills (Q5_7)	○	○	○	○
Developing public speaking/presentation skills (Q5_8)	○	○	○	○

Q6 **Please indicate the extent to which the items in this list were part of your intellectual development in the Core:**

	Never (0)	Rarely (1)	Sometimes (2)	Often (3)
Applying facts, theories, or methods to practical problems or in new situations (Q6_1)	○	○	○	○
Developing the ability to think critically (Q6_2)	○	○	○	○
Learning to think like a practitioner of each discipline represented in Core (e.g., biologist, chemist) (Q6_3)	○	○	○	○
Learning to think like a humanist, social scientist, or artist (Q6_4)	○	○	○	○
Learning to evaluate and interpret information (Q6_5)	○	○	○	○
Learning to discern relevant and reliable information to support an argument (Q6_6)	○	○	○	○
Having time to reflect on material covered in each of the courses (Q6_7)	○	○	○	○

Q7 **Please indicate the extent to which the items in this list were part of your personal development in the Core:**

	Never (0)	Rarely (1)	Sometimes (2)	Often (3)
Learning what you are capable of intellectually (Q7_1)	○	○	○	○
Developing a sense of curiosity and wonder (Q7_2)	○	○	○	○
Finding what you want to do in life (Q7_3)	○	○	○	○
Promoting life-long learning (Q7_4)	○	○	○	○
Gaining self-confidence (Q7_5)	○	○	○	○
Exploring ideas that were new to you (Q7_6)	○	○	○	○
Being challenged to do your best work (Q7_8)	○	○	○	○
Learning how to manage time (Q7_9)	○	○	○	○
Learning to work collaboratively (Q7_10)	○	○	○	○
Accepting that mistakes are part of the learning process (Q7_11)	○	○	○	○
Other (please specify) (Q7_12)	○	○	○	○

End of Block

Priority of Core

Q8 **Regardless of your experience in the Core, please indicate the priority level each of these items should have in the Core <u>going forward</u>:**

	None (0)	Low (1)	Medium (2)	High (3)
Sharing a common experience with my classmates (Q8_1)	○	○	○	○
Sharing a common experience with all Mudders (Q8_2)	○	○	○	○
Meeting and/or learning about people different than me (Q8_3)	○	○	○	○
Developing a sense of belonging to a STEM community (Q8_4)	○	○	○	○

Q9 **Regardless of your experience in the Core, please indicate the priority level each of these items should have in the Core <u>going forward</u>:**

	None (0)	Low (1)	Medium (2)	High (3)
Developing leadership skills (Q9_1)	○	○	○	○
Understanding the impact of scientific work on society (Q9_2)	○	○	○	○
Understanding the moral and ethical implications underlying my work (Q9_3)	○	○	○	○

Page Break

Q10 **Regardless of your experience in the Core, please indicate the priority level each of these items should have in the Core going forward:**

	None (0)	Low (1)	Medium (2)	High (3)
Exposure to a wide range of STEM disciplines (Q10_1)	○	○	○	○
Learning more than just "the basics" in a wide array of STEM disciplines (Q10_2)	○	○	○	○
Building a "technical toolkit" that is a foundation for more advanced study in STEM (Q10_3)	○	○	○	○
Preparing for study in your choice of major (Q10_4)	○	○	○	○
Learning to cross disciplinary boundaries (Q10_5)	○	○	○	○
Covering a lot of content (Q10_6)	○	○	○	○
Developing writing skills (Q10_7)	○	○	○	○
Developing public speaking/presentation skills (Q10_8)	○	○	○	○

Q11 **Regardless of your experience in the Core, please indicate the priority level each of these items should have in the Core going forward:**

	None (0)	Low (1)	Medium (2)	High (3)
Applying facts, theories, or methods to practical problems or in new situations (Q11_1)	○	○	○	○
Developing the ability to think critically (Q11_2)	○	○	○	○
Learning to think like a practitioner of each discipline represented in Core (e.g., biologist, chemist) (Q11_3)	○	○	○	○
Learning to think like a humanist, social scientist, or artist (Q11_4)	○	○	○	○
Learning to evaluate and interpret information (Q11_5)	○	○	○	○
Learning to discern relevant and reliable information to support an argument (Q11_6)	○	○	○	○
Having time to reflect on material covered in each of the courses (Q11_7)	○	○	○	○

Q12 **Regardless of your experience in the Core, please indicate the priority level each of these items should have in the Core going forward:**

	None (0)	Low (1)	Medium (2)	High (3)
Learning what you are capable of intellectually (Q12_1)	○	○	○	○
Developing a sense of curiosity and wonder (Q12_2)	○	○	○	○
Finding what you want to do in life (Q12_3)	○	○	○	○
Promoting life-long learning (Q12_4)	○	○	○	○
Gaining self-confidence (Q12_5)	○	○	○	○
Exploring ideas that were new to you (Q12_6)	○	○	○	○
Being challenged to do your best work (Q12_7)	○	○	○	○
Learning how to manage time (Q12_8)	○	○	○	○
Learning to work collaboratively (Q12_9)	○	○	○	○
Accepting that mistakes are part of the learning process (Q12_10)	○	○	○	○
Other (please specify) (Q12_11)	○	○	○	○

Q13 **A spring 2017 external evaluation of the Core yielded several possible aspirations for the curriculum. Please arrange each of these in order of importance to you, with 1 being the most important and 7 being the least important. (Please click and drag an item to move it to the position you want)**

_____ Building interdisciplinary facility (e.g., equipping students to engage across disciplinary boundaries) (1)
_____ Helping students choose a major (2)
_____ Helping students discover what they are capable of intellectually and technically (3)
_____ Helping students learn to work efficiently and productively (4)
_____ Inspiring in students a sense of curiosity and excitement about what is possible in a discipline (5)
_____ Learning a little bit about a wide range of STEM disciplines (6)
_____ Providing a "technical toolkit" that acts as a foundation for advanced study in STEM (7)

Q14 **How would you explain to an incoming HMC student the role of the Core Curriculum?**

_____

_____

_____

_____

_____

Q15 **Going forward, what is an appropriate balance between breadth and depth in the Core Curriculum?**

_____

_____

_____

_____

_____

Q16 **Going forward, how important is it that the Core Curriculum have a workload that allows the majority of students the time to pursue extracurricular passions like music, community service, student government, team sports, etc?**

_____

_____

_____

_____

_____

End of Block

Effort and Learning in Core

Q79 **This next section asks you to think about your effort and learning in the core courses you have <u>taken</u>. Because course names and numbers have changed over time, you will not have completed all the courses listed, and may not have taken them in the order they are shown.**
****If you have taken a course more than one time, please respond with your experience the FIRST time taking the course.**
****If you exam/waivered out of a course, have not yet taken a course, are currently enrolled in a course for the first time, or if a version of a course does not apply to you, please do not move that course into a box.**

Q80 **How would you characterize your experience overall in the following first semester core courses:**
(Drag and drop the course into the appropriate box)

High Effort/Learned a lot	High Effort/Learned a little	Low Effort/Learned a lot	Low Effort/Learned a little
_____ Chem 23 A (2)	_____ Chem 23 A (2)	_____ Chem 23 A (2)	_____ Chem 23 A (2)
_____ Chem 23 D (Dynamics) (14)	_____ Chem 23 D (Dynamics) (14)	_____ Chem 23 D (Dynamics) (14)	_____ Chem 23 D (Dynamics) (14)
_____ Chem 23 E (Energetics) (7)	_____ Chem 23 E (Energetics) (7)	_____ Chem 23 E (Energetics) (7)	_____ Chem 23 E (Energetics) (7)
_____ CS 5 (Gold, Black or Green) (3)	_____ CS 5 (Gold, Black or Green) (3)	_____ CS 5 (Gold, Black or Green) (3)	_____ CS 5 (Gold, Black or Green) (3)
_____ CS 42 (12)	_____ CS 42 (12)	_____ CS 42 (12)	_____ CS 42 (12)
_____ Math 30 B (4)	_____ Math 30 B (4)	_____ Math 30 B (4)	_____ Math 30 B (4)
_____ Math 30 G (5)	_____ Math 30 G (5)	_____ Math 30 G (5)	_____ Math 30 G (5)
_____ Math 35 (6)	_____ Math 35 (6)	_____ Math 35 (6)	_____ Math 35 (6)
_____ Phys 23 (13)	_____ Phys 23 (13)	_____ Phys 23 (13)	_____ Phys 23 (13)
_____ Writ 1 (1)	_____ Writ 1 (1)	_____ Writ 1 (1)	_____ Writ 1 (1)

Q81 **How often first semester did you have enough time to pursue interests outside of class and homework?**

- ○ Never (1)
- ○ Rarely (2)
- ○ Sometimes (3)
- ○ Often (4)
- ○ Always (5)

Q82 **How would you characterize your experience overall in the following second semester core courses**:
(Drag and drop the course into the appropriate box)

High Effort/Learned a lot	High Effort/Learned a little	Low Effort/Learned a lot	Low Effort/Leanred a little
_____ Bio 52 (11)	_____ Bio 52 (11)	_____ Bio 52 (11)	_____ Bio 52 (11)
_____ Chem 23 B (2)	_____ Chem 23 B (2)	_____ Chem 23 B (2)	_____ Chem 23 B (2)
_____ Chem 23 S (Structure) (8)	_____ Chem 23 S (Structure) (8)	_____ Chem 23 S (Structure) (8)	_____ Chem 23 S (Structure) (8)
_____ Chem 24 (3)	_____ Chem 24 (3)	_____ Chem 24 (3)	_____ Chem 24 (3)
_____ HSA 10 (4)	_____ HSA 10 (4)	_____ HSA 10 (4)	_____ HSA 10 (4)
_____ Math 40 (9)	_____ Math 40 (9)	_____ Math 40 (9)	_____ Math 40 (9)
_____ Math 45 (10)	_____ Math 45 (10)	_____ Math 45 (10)	_____ Math 45 (10)
_____ Phys 22 (5)	_____ Phys 22 (5)	_____ Phys 22 (5)	_____ Phys 22 (5)
_____ Phys 24 (6)	_____ Phys 24 (6)	_____ Phys 24 (6)	_____ Phys 24 (6)
_____ Phys 24A (7)	_____ Phys 24A (7)	_____ Phys 24A (7)	_____ Phys 24A (7)
_____ Writ 1E (1)	_____ Writ 1E (1)	_____ Writ 1E (1)	_____ Writ 1E (1)

Q83 **How often second semester did you have enough time to pursue interests outside of class and homework?**

- ○ Never (1)
- ○ Rarely (2)
- ○ Sometimes (3)
- ○ Often (4)
- ○ Always (5)

Q84 **How would you characterize your experience overall in the following third semester core courses**:
(Drag and drop the course into the appropriate box)

High Effort/Learned a lot	High Effort/Learned a little	Low Effort/Learned a lot	Low Effort/Learned a little
_____ CL 57 (1)	_____ CL 57 (1)	_____ CL 57 (1)	_____ CL 57 (1)
_____ Engr 59 (2)	_____ Engr 59 (2)	_____ Engr 59 (2)	_____ Engr 59 (2)
_____ Engr 79 (3)	_____ Engr 79 (3)	_____ Engr 79 (3)	_____ Engr 79 (3)
_____ Math 60 (4)	_____ Math 60 (4)	_____ Math 60 (4)	_____ Math 60 (4)
_____ Math 65 (7)	_____ Math 65 (7)	_____ Math 65 (7)	_____ Math 65 (7)
_____ Phys 51 (5)	_____ Phys 51 (5)	_____ Phys 51 (5)	_____ Phys 51 (5)

Q85 **How often third semester did you have enough time to pursue interests outside of class and homework?**

- Never (1)
- Rarely (2)
- Sometimes (3)
- Often (4)
- Always (5)

Page Break

End of Block

About you

Q17 These next few questions ask for a bit of information about you. As a reminder, your responses are confidential and will only be reported in aggregate.

Q18 **Your class year**

- [ ] 2018 (1)
- [ ] 2019 (2)
- [ ] 2020 (3)
- [ ] Other (4) _____

Q19 **Your gender:**

- ○ Male (1)
- ○ Female (2)
- ○ Nonbinary/gender nonconforming (3)

Q20 **I am a first-generation college student.**
(For the purposes of this survey, a first-generation college student is defined as a student whose parent(s)/legal guardian(s) have not completed a bachelor's degree.)

- ○ Yes (1)
- ○ No (0)

Q21 **Your racial/ethnic identity:**
(select all that apply)

- [ ] Native American or Alaska Native (1)
- [ ] African-American/Black (2)
- [ ] East Asian (e.g., Chinese, Japanese, Korean, Taiwanese) (3)
- [ ] Filipino (4)
- [ ] Southeast Asian (e.g., Cambodian, Vietnamese, Hmong) (5)
- [ ] South Asian (e.g., Indian, Pakistani, Nepalese, Sri Lankan) (6)
- [ ] Other Asian (7)
- [ ] Native Hawaiian/Pacific Islander (8)
- [ ] Mexican American/Chicano (9)
- [ ] Puerto Rican (10)
- [ ] Other Latino (11)
- [ ] White or Middle Eastern (12)
- [ ] Another race/ethnicity not listed (please provide) (13)

_____

Q22 **Your declared major(s):**
(check all that apply)

- [ ] Undeclared (15)
- [ ] Biology (1)
- [ ] Mathematical and Computational Biology (2)
- [ ] Chemistry (3)
- [ ] Joint major in Biology and Chemistry (4)
- [ ] Joint major in Mathematics and Biology (5)
- [ ] Computer Science (6)
- [ ] Joint major in Computer Science and Mathematics (7)
- [ ] Engineering (8)
- [ ] Mathematics (9)
- [ ] Physics (10)
- [ ] Joint major in Mathematics and Physics (11)
- [ ] IPS (12)
- [ ] Off-Campus Major (please describe) (13) _____
- [ ] Other (please describe) (14) _____

Q23 **We may wish to contact you to understand your responses in more depth. Do you give permission to HMC to follow up with you about your responses to this survey?**

- ○ Yes (1)
- ○ No (0)

Display This Question:

If We may wish to contact you to understand your responses in more depth. Do you give permission to... = Yes

Q24 Great! Please provide your contact information here. The information you share here will only be used to follow up with you regarding your responses to this survey.

- ○ Name (1) _____
- ○ Email (2) _____

End of Block

Final Thoughts

Q25 **Please use this space to tell us anything else you would like to add about your experience in the Core at Harvey Mudd College.**

_____

_____

_____

_____

_____

End of Block

CRPT Survey 2017-Faculty&Staff

Instructions

Harvey Mudd College has initiated a review of its Core Curriculum. The Core Review Planning Team seeks to understand the impact of the Core Curriculum on various campus constituencies and, as part of this process, we are asking Faculty and Staff to complete the following survey.

It should take about fifteen minutes to complete this survey. Your participation is voluntary and your responses confidential. Those with permission or authority to see the information in the survey will maintain its confidentiality to the extent permitted and required by laws and college policies.

If you have questions about this survey and how the results will be used in the Core review, you may contact Dr. Laura Palucki Blake, Director of Institutional Research and Effectiveness at lpblake@hmc.edu.

End of Block

Experience in Core

These questions ask you about the Common Core Curriculum ("the Core"). The Core means different things to different people, however for the purposes of this survey, it should be understood as:

The coordinated, common foundation (found in the early semesters of an HMC education) which blends the STEM disciplines—math, physics, chemistry, biology, computer science and engineering—as well as including classes in writing and critical inquiry.

Because the Core has evolved over time and is different for each person, not all the response options will apply to everyone. Please choose the options that best describe your experience.

Please indicate the extent to which the items in this list are part of the community experience in the Core:

	Never	Rarely	Sometimes	Often
Sharing a common experience with my classmates				
Sharing a common experience with all Mudders				
Meeting and/or learning about people different than me				
Developing a sense of belonging to a STEM community				

Please indicate the extent to which the items in this list are part of the ethics and leadership development in the Core:

	Never	Rarely	Sometimes	Often
Developing leadership skills				
Understanding the impact of scientific work on society				
Understanding the moral and ethical implications underlying my work				

Please indicate the extent to which the items in this list are part of the technical development in the Core:

	Never	Rarely	Sometimes	Often
Exposure to a wide range of STEM disciplines				
Learning more than just "the basics" in a wide array of STEM disciplines				
Building a "technical toolkit" that is a foundation for more advanced study in STEM				
Preparing for study in your choice of major				
Learning to cross disciplinary boundaries				
Covering a lot of content				
Developing writing skills				
Developing public speaking/presentation skills				

Please indicate the extent to which the items in this list are part of intellectual development in the Core:

	Never	Rarely	Sometimes	Often
Applying facts, theories, or methods to practical problems or in new situations				
Developing the ability to think critically				
Learning to think like a practitioner of each discipline represented in Core (e.g., biologist, chemist)				
Learning to think like a humanist, social scientist, or artist				
Learning to evaluate and interpret information				
Learning to discern relevant and reliable information to support an argument				
Having time to reflect on material covered in each of the courses				

Please indicate the extent to which the items in this list are part of personal development in the Core:

	Never	Rarely	Sometimes	Often
Learning what you are capable of intellectually				
Developing a sense of curiosity and wonder				
Finding what you want to do in life				
Promoting life-long learning				
Gaining self-confidence				
Exploring ideas that were new to you				
Being challenged to do your best work				
Learning how to manage time				
Learning to work collaboratively				
Accepting that mistakes are part of the learning process				
Other (please specify)				

End of Block

Priority of Core

Regardless of your experience with Core, please indicate the priority level each of these items should have in the Core going forward:

	None	Low	Medium	High
Sharing a common experience with my classmates				
Sharing a common experience with all Mudders				
Meeting and/or learning about people different than me				
Developing a sense of belonging to a STEM community				

Regardless of your experience with Core, please indicate the priority level each of these items should have in the Core going forward:

	None	Low	Medium	High
Developing leadership skills				
Understanding the impact of scientific work on society				
Understanding the moral and ethical implications underlying my work				

Regardless of your experience with Core, please indicate the priority level each of these items should have in the Core going forward:

	None	Low	Medium	High
Exposure to a wide range of STEM disciplines				
Learning more than just "the basics" in a wide array of STEM disciplines				
Building a "technical toolkit" that is a foundation for more advanced study in STEM				
Preparing for study in your choice of major				
Learning to cross disciplinary boundaries				
Covering a lot of content				
Developing writing skills				
Developing public speaking/presentation skills				

Regardless of your experience with Core, please indicate the priority level each of these items should have in the Core going forward:

	None	Low	Medium	High
Applying facts, theories, or methods to practical problems or in new situations				
Developing the ability to think critically				
Learning to think like a practitioner of each discipline represented in Core (e.g., biologist, chemist)				
Learning to think like a humanist, social scientist, or artist				
Learning to evaluate and interpret information				
Learning to discern relevant and reliable information to support an argument				
Having time to reflect on material covered in each of the courses				

Regardless of your experience with Core, please indicate the priority level each of these items should have in the Core going forward:

	None	Low	Medium	High
Learning what you are capable of intellectually				
Developing a sense of curiosity and wonder				
Finding what you want to do in life				
Promoting life-long learning				
Gaining self-confidence				
Exploring ideas that were new to you				
Being challenged to do your best work				
Learning how to manage time				
Learning to work collaboratively				
Accepting that mistakes are part of the learning process				
Other (please specify)				

Page Break

A spring 2017 external evaluation of the Core yielded several possible aspirations for the curriculum. Please arrange each of these in order of importance to you, with 1 being the most important and 7 being the least important. (click and drag to move the items)

_____ Building interdisciplinary facility (e.g., equipping students to engage across disciplinary boundaries)
_____ Helping students choose a major
_____ Helping students discover what they are capable of intellectually and technically
_____ Helping students learn to work efficiently and productively
_____ Inspiring in students a sense of curiosity and excitement about what is possible in a discipline
_____ Learning a little bit about a wide range of STEM disciplines
_____ Providing a "technical toolkit" that acts as a foundation for advanced study in STEM

Page Break

How would you explain to an incoming HMC student the role of the Core Curriculum?

_____

_____

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_____

Going forward, what is an appropriate balance between breadth and depth in the Core Curriculum?

_____

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_____

Going forward, how important is it that the Core Curriculum have a workload that allows the majority of students the time to pursue extracurricular passions like music, community service, student government, team sports, etc?

_____

_____

_____

_____

_____

End of Block

About you

These next few questions ask for a bit of information about you. As a reminder, your responses are confidential and will only be reported in aggregate.

I am a

Faculty member

Staff member

Your gender:

Male

Female

Nonbinary/gender nonconforming

I was a first-generation college student.
(For the purposes of this survey, a first-generation college student is defined as a student whose parent(s)/legal guardian(s) have not completed a bachelor's degree.)

Yes

No

Your racial/ethnic identity:
(select all that apply)

Native American or Alaska Native

African-American/Black

East Asian (e.g., Chinese, Japanese, Korean, Taiwanese)

Filipino

Southeast Asian (e.g., Cambodian, Vietnamese, Hmong)

South Asian (e.g., Indian, Pakistani, Nepalese, Sri Lankan)

Other Asian

Native Hawaiian/Pacific Islander

Mexican American/Chicano

Puerto Rican

Other Latino

White or Middle Eastern

Another race/ethnicity not listed (please provide)
_____

Your departmental affiliation:
(check all that apply)

Biology

Chemistry

Computer Science

Engineering

Humanities, Social Sciences, and the Arts

Mathematics

Physics

Other (please describe) _____

We may wish to contact you to understand your responses in more depth. Do you give permission to the CRPT to follow up with you about your responses to this survey?

Yes

No

Great! Please provide your contact information here. The information you share here will only be used to follow up with you regarding your responses to this survey.

Name _____

Email _____

End of Block

Final Thoughts

Please use this space to tell us anything else you would like to add about your experience in the Core at Harvey Mudd College and its subsequent impact on you personally and professionally.

_____

_____

_____

_____

_____

End of Block

CRPT Survey 2017-Alumni

Start of Block: Instructions

Q1 Harvey Mudd College has initiated a review of its Core Curriculum. The Core Review Planning Team seeks to understand the impact of the Core Curriculum on various campus constituencies and, as part of this process, we are asking alumni to complete the following survey.

It should take about fifteen minutes to complete this survey. Your participation is voluntary and your responses confidential. Those with permission or authority to see the information in the survey will maintain its confidentiality to the extent permitted and required by laws and college policies.

If you have questions about this survey and how the results will be used in the Core review, you may contact Dr. Laura Palucki Blake, Director of Institutional Research and Effectiveness at lpblake@hmc.edu.

End of Block: Instructions

Start of Block: Experience in Core

Q2 These questions ask you about the Common Core Curriculum ("the Core"). The Core means different things to different people, however for the purposes of this survey, it should be understood as:

The coordinated, common foundation (found in the early semesters of an HMC education) which blends the STEM disciplines—math, physics, chemistry, biology, computer science and engineering—as well as including classes in writing and critical inquiry.

Because the Core has evolved over time and is different for each person, not all the response options will apply to everyone. Please choose the options that best describe your experience.

Q3 **Please indicate the extent to which the items in this list were part of your community experience in the Core:**

	Never (0)	Rarely (1)	Sometimes (2)	Often (3)
Sharing a common experience with my classmates (Q3_1)				
Sharing a common experience with all Mudders (Q3_2)				
Meeting and/or learning about people different than me (Q3_3)				
Developing a sense of belonging to a STEM community (Q3_4)				

Q4 **Please indicate the extent to which the items in this list were part of your ethics and leadership development in the Core:**

	Never (0)	Rarely (1)	Sometimes (2)	Often (3)
Developing leadership skills (Q4_1)				
Understanding the impact of scientific work on society (Q4_2)				
Understanding the moral and ethical implications underlying my work (Q4_3)				

Page Break

Q5 **Please indicate the extent to which the items in this list were part of your technical development in the Core:**

	Never (0)	Rarely (1)	Sometimes (2)	Often (3)
Exposure to a wide range of STEM disciplines (Q5_1)				
Learning more than just "the basics" in a wide array of STEM disciplines (Q3_2)				
Building a "technical toolkit" that is a foundation for more advanced study in STEM (Q5_3)				
Preparing for study in your choice of major (Q5_4)				
Learning to cross disciplinary boundaries (Q5_5)				
Covering a lot of content (Q5_6)				
Developing writing skills (Q5_7)				
Developing public speaking/presentation skills (Q5_8)				

Q6 **Please indicate the extent to which the items in this list were part of your intellectual development in the Core:**

	Never (0)	Rarely (1)	Sometimes (2)	Often (3)
Applying facts, theories, or methods to practical problems or in new situations (Q6_1)				
Developing the ability to think critically (Q6_2)				
Learning to think like a practitioner of each discipline represented in Core (e.g., biologist, chemist) (Q6_3)				
Learning to think like a humanist, social scientist, or artist (Q6_4)				
Learning to evaluate and interpret information (Q6_5)				
Learning to discern relevant and reliable information to support an argument (Q6_6)				
Having time to reflect on material covered in each of the courses (Q6_7)				

Page Break

Q7 **Please indicate the extent to which the items in this list were part of your personal development in the Core:**

	Never (0)	Rarely (1)	Sometimes (2)	Often (3)
Learning what you are capable of intellectually (Q7_1)				
Developing a sense of curiosity and wonder (Q7_2)				
Finding what you want to do in life (Q7_3)				
Promoting life-long learning (Q7_4)				
Gaining self-confidence (Q7_5)				
Exploring ideas that were new to you (Q7_6)				
Being challenged to do your best work (Q7_8)				
Learning how to manage time (Q7_9)				
Learning to work collaboratively (Q7_10)				
Accepting that mistakes are part of the learning process (Q7_11)				
Other (please specify) (Q7_12)				

Page Break

End of Block: Experience in Core

Start of Block: Priority of Core

Q8 **Regardless of your experience in the Core, please indicate the priority level each of these items should have in the Core going forward:**

	None (0)	Low (1)	Medium (2)	High (3)
Sharing a common experience with my classmates (Q8_1)				
Sharing a common experience with all Mudders (Q8_2)				
Meeting and/or learning about people different than me (Q8_3)				
Developing a sense of belonging to a STEM community (Q8_4)				

Q9 **Regardless of your experience in the Core, please indicate the priority level each of these items should have in the Core <u>going forward</u>:**

	None (0)	Low (1)	Medium (2)	High (3)
Developing leadership skills (Q9_1)				
Understanding the impact of scientific work on society (Q9_2)				
Understanding the moral and ethical implications underlying my work (Q9_3)				

Page Break

Q10 **Regardless of your experience in the Core, please indicate the priority level each of these items should have in the Core going forward:**

	None (0)	Low (1)	Medium (2)	High (3)
Exposure to a wide range of STEM disciplines (Q10_1)				
Learning more than just "the basics" in a wide array of STEM disciplines (Q10_2)				
Building a "technical toolkit" that is a foundation for more advanced study in STEM (Q10_3)				
Preparing for study in your choice of major (Q10_4)				
Learning to cross disciplinary boundaries (Q10_5)				
Covering a lot of content (Q10_6)				
Developing writing skills (Q10_7)				
Developing public speaking/presentation skills (Q10_8)				

Q11 **Regardless of your experience in the Core, please indicate the priority level each of these items should have in the Core going forward:**

	None (0)	Low (1)	Medium (2)	High (3)
Applying facts, theories, or methods to practical problems or in new situations (Q11_1)				
Developing the ability to think critically (Q11_2)				
Learning to think like a practitioner of each discipline represented in Core (e.g., biologist, chemist) (Q11_3)				
Learning to think like a humanist, social scientist, or artist (Q11_4)				
Learning to evaluate and interpret information (Q11_5)				
Learning to discern relevant and reliable information to support an argument (Q11_6)				
Having time to reflect on material covered in each of the courses (Q11_7)				

Page Break

Q12 **Regardless of your experience in the Core, please indicate the priority level each of these items should have in the Core <u>going forward</u>:**

	None (0)	Low (1)	Medium (2)	High (3)
Learning what you are capable of intellectually (Q12_1)				
Developing a sense of curiosity and wonder (Q12_2)				
Finding what you want to do in life (Q12_3)				
Promoting life-long learning (Q12_4)				
Gaining self-confidence (Q12_5)				
Exploring ideas that were new to you (Q12_6)				
Being challenged to do your best work (Q12_7)				
Learning how to manage time (Q12_8)				
Learning to work collaboratively (Q12_9)				
Accepting that mistakes are part of the learning process (Q12_10)				
Other (please specify) (Q12_11)				

Page Break

Q13 **A spring 2017 external evaluation of the Core yielded several possible aspirations for the curriculum. Please arrange each of these in order of importance to you, with 1 being the most important and 7 being the least important.**

_____ Building interdisciplinary facility (e.g., equipping students to engage across disciplinary boundaries) (1)
_____ Helping students choose a major (2)
_____ Helping students discover what they are capable of intellectually and technically (3)
_____ Helping students learn to work efficiently and productively (4)
_____ Inspiring in students a sense of curiosity and excitement about what is possible in a discipline (5)
_____ Learning a little bit about a wide range of STEM disciplines (6)
_____ Providing a "technical toolkit" that acts as a foundation for advanced study in STEM (7)

Page Break

Q14 **How would you explain to an incoming HMC student the role of the Core Curriculum?**

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_____

Q15 **Going forward, what is an appropriate balance between breadth and depth in the Core Curriculum?**

_____

_____

_____

_____

_____

Q16 **Going forward, how important is it that the Core Curriculum have a workload that allows the majority of students the time to pursue extracurricular passions like music, community service, student government, team sports, etc?**

_____

_____

_____

_____

_____

End of Block: Priority of Core

Start of Block: About you

Q17 These next few questions ask for a bit of information about you. As a reminder, your responses are confidential and will only be reported in aggregate.

Q18 **Your class year**

▼ 2017 (1) ... 1953 (65)

Q19 **Your gender:**

Male (1)

Female (2)

Nonbinary/gender nonconforming (3)

Q20 **I was a first-generation college student.**
(For the purposes of this survey, a first-generation college student is defined as a student whose parent(s)/legal guardian(s) have not completed a bachelor's degree.)

Yes (1)

No (0)

Q21 **Your racial/ethnic identity:**
(select all that apply)

Native American or Alaska Native (1)

African-American/Black (2)

East Asian (e.g., Chinese, Japanese, Korean, Taiwanese) (3)

Filipino (4)

Southeast Asian (e.g., Cambodian, Vietnamese, Hmong) (5)

South Asian (e.g., Indian, Pakistani, Nepalese, Sri Lankan) (6)

Other Asian (7)

Native Hawaiian/Pacific Islander (8)

Mexican American/Chicano (9)

Puerto Rican (10)

Other Latino (11)

White or Middle Eastern (12)

Another race/ethnicity not listed (please provide) (13)

_____

Q22 **Your major(s):**
(check all that apply)

- Biology (1)
- Mathematical and Computational Biology (2)
- Chemistry (3)
- Joint major in Biology and Chemistry (4)
- Joint major in Mathematics and Biology (5)
- Computer Science (6)
- Joint major in Computer Science and Mathematics (7)
- Engineering (8)
- Mathematics (9)
- Physics (10)
- Joint major in Mathematics and Physics (11)
- IPS (12)
- Off-Campus Major (please describe) (13) _____
- Other (please describe) (14) _____

Q23 **We may wish to contact you to understand your responses in more depth. Do you give permission to HMC to follow up with you about your responses to this survey?**

- Yes (1)
- No (0)

Display This Question:

If We may wish to contact you to understand your responses in more depth. Do you give permission to... = Yes

Q24 Great! Please provide your contact information here. The information you share here will only be used to follow up with you regarding your responses to this survey.

Name (1) _____

Email (2) _____

Phone (3) _____

End of Block: About you

Start of Block: Final Thoughts

Q25 **Please use this space to tell us anything else you would like to add about your experience in the Core at Harvey Mudd College and its subsequent impact on you personally and professionally.**

_____

_____

_____

_____

_____

End of Block: Final Thoughts

The Harvey Mudd College Core Curriculum:
Spring 2017 External Evaluation Report

Cassandra Volpe Horii, Ph.D.,[1] and Jennifer E. Weaver, Ph.D.[2]

EXECUTIVE SUMMARY

In March 2017, at the request of the Faculty Executive Committee, we conducted an external evaluation of the Core Curriculum at Harvey Mudd College, informed by existing documents, data, and a campus visit involving faculty (including those with administrative roles related to the Core), students, and alumni. The FEC sought answers to these questions:

1. From an external perspective, what would you say are our goals as a college for the Core?
2. How well does the Core currently achieve these goals?
3. How well does the current Core address the College Mission Statement?
4. How well does the current Core meet the needs and interests of our students?
5. What effect does the Core have on faculty?
6. Given the goals and constraints, what are some pathways we could explore to improve our Core?
7. What is our vision for the Core Curriculum moving forward?

In this report, we synthesize discussions with campus stakeholders, addressing the above questions and related topics, in the following sections:

Convergence and Divergence about the Core (Questions 4-5)

- Faculty, students, and alumni demonstrated patterns of agreement and disagreement about Core.
- They generally agreed that Core is a strong and valuable hallmark of HMC, which reinforces a shared culture/work ethic and provides intense preparation for/exposure to STEM disciplines, but is often overwhelming and does not significantly address the latter half of the HMC mission.
- They perceive different challenges regarding changing Core.
- These groups differed in their understanding of Core's goals, in practice and in aspiration.
- More specific strengths (tracks, Writ 1), weaknesses (half courses, non-tech electives, and math sequencing), and mixed comments (selecting majors based on Core, sidecars) noted by faculty and students are summarized.

Core Goals and the HMC Mission (Questions 1-3, 7)

- Students and alumni articulated the in-practice goals of the Core as: learning what they are capable of intellectually and technically, learning to prioritize and work efficiently/productively, and learning a little bit about a wide range of STEM disciplines.
- The top competing goals among faculty were: providing students with a "technical toolkit" and foundation for more advanced study in STEM, building interdisciplinary facility, inspiring students' sense of curiosity and wonder, and recruiting students to the majors.
- Various goals are in conflict with each other, leading to difficulty in redesigning/changing Core.
- The in-practice goals of Core are implicit and not clearly prioritized. At this time, there is not a shared HMC vision for the Core.

Pathways Forward for the Core Curriculum (Question 6)

- Greater clarity and agreement about the top one or two mutually compatible goal(s) of Core are crucial, but should not hold up creative next steps that can happen in parallel.
- To move forward in a timely manner, we suggest loosening the hold on implementing small changes and pilots, so that the full scope of faculty creativity and innovative thinking can emerge and help inform Core discussions.
- Establishing conditions under which faculty can make changes without official approval on a pilot basis, and creating non-committee venues for open-ended discussion where there are no high-stakes decisions on the table, may help create positive momentum.
- Two organizational aspects for consideration in HMC's next steps for the Core were emphasized by faculty: (1) the importance of the Core director and ways to increase the coordination and accountability provided by this role on campus, and (2) the importance of sustainability in planning changes to the Core, coupled with the current context of change and growth.
- Additional specific ideas offered by faculty and students are summarized.

Closing Thoughts

Two additional topics related to the changing context at HMC, *growth/staffing* and *increasing diversity*, may need to be addressed directly and openly and in a different context than Core decisions. Both topics lie just beneath the surface in discussions about Core, but can be especially charged and/or difficult to articulate.

We strongly emphasize how unique and important HMC's Core is and how many benefits it confers to students, faculty, and the institution as a whole. We have rarely encountered an institution so passionate about its curriculum, students, and collective purpose; this strong base for collaboration will support HMC through the next phase of development for its distinctive Core curriculum.

1. INTRODUCTION

In January 2017, members of Harvey Mudd College (HMC) Faculty Executive Committee (FEC) requested a brief external evaluation of the Core Curriculum, informed by existing documents and data coupled with a campus visit, so that HMC could "better understand our community vision of the Core, what we are doing, why we are doing it, and how we might improve it." This evaluation and report were intended to inform the FEC and other HMC offices and bodies, in preparation for possible next steps.

The particular questions that the FEC sought to answer were:

1. From an external perspective, what would you say are our goals as a college for the Core?
2. How well does the Core currently achieve these goals?
3. How well does the current Core address the College Mission Statement?
4. How well does the current Core meet the needs and interests of our students?
5. What effect does the Core have on faculty?
6. Given the goals and constraints, what are some pathways we could explore to improve our Core?
7. What is our vision for the Core Curriculum moving forward?

Documents provided to us by the Office of Institutional Research and Effectiveness prior to the visit included descriptions and charts of the Core structure, reports from committees working on Core changes and assessment (e.g., Strategic Vision Curriculum Implementation Committee, Writing Course Subcommittee), departmental/program reviews addressing Core effectiveness, and other special reports such as that of the Wabash consultants (see Appendix A for complete list).

When we came to campus on March 6, 2017, we met with a total of 40 faculty, 27 students (both first year and upper year, the latter consisting of sophomores, juniors, and seniors), and five alumni (graduation years 1965 through 1997). Meetings included several committees/working groups, focus groups that were open to anyone by sign-up through the Office of Institutional Research and Effectiveness, and individuals over the course of a 9-hour day. Several sessions in parallel, facilitated by two consultants in different locations, enabled broad and deep engagement with faculty and student focus groups (see appendix B for schedule). Although the background documents helped us establish a history of Core changes and discussions, provided context for our conversations, and informed the structure of the day, we made a distinct effort to draw a line between this background information and the current status and issues as discussed on March 6. In order to provide HMC with as current and independent a perspective as possible, what follows in this report focuses on the themes and voices from that visit.

However, it is important to keep in mind that much of the information discussed in these meetings was not new; conversations frequently referenced the history of Core discussion and study. In some cases, faculty, students, and alumni reacted not only to their experiences, but also to shared narratives about the Core, which have been repeated and reinforced through formal and informal networks over the years. We emphasize that the ongoing, sometimes exhaustive, discussions about the Core are an important aspect of the context. In the subsequent sections, we strive to bring to light less what these studies and conversations have already articulated, and more the 10,000-foot view of why the questions above are not already clear, given the abundance of data and reflection, and the key agreements and disagreements underlying the shared high regard for the HMC Core together with the sense of impasse that was expressed to us in many ways throughout this process.

2. CONVERGENCE AND DIVERGENCE ABOUT THE CORE

We begin with an account of themes from the campus visit with the clearest agreement and disagreement across the main stakeholders in the HMC Core Curriculum: Faculty (including deans, chairs, the Core director, and similar faculty-held administrative roles), Students, and Alumni.

Table 1: Main Themes Reported During the Campus Visit, arranged according to agreement across stakeholder groups.

KEY	High agreement	Medium agreement	Low agreement

<table>
<tr><th>FACULTY</th><th>STUDENTS</th><th>ALUMNI</th></tr>
<tr><td colspan="3">Love-hate relationship with Core:
Core is unique and important, provides intense preparation for and exposure to STEM disciplines, and facilitates bonding among students. However, Core is also a heavy load that leads to (possibly unnecessary) burnout and overwhelm</td></tr>
<tr><td colspan="3">HMC Culture and Core:
Core reinforces a shared culture and common personality traits among many faculty and students—the tendency to do more and more, to work very hard to the exclusion of all else, and to center one's identity mainly in one's academic work while sacrificing other interests and identities</td></tr>
<tr><td colspan="3">HMC Mission and Core (current status):
Core largely does not address the leadership and societal impact aspects of the mission, except in small or scattered ways, in certain courses</td></tr>
<tr><th>FACULTY</th><th>STUDENTS</th><th>ALUMNI</th></tr>
<tr><td>Core Goals:
Core is important as a technical toolkit, as a basis for interdisciplinary facility, as recruitment for majors, and as a source of curiosity and wonder</td><td colspan="2">Core Goals:
Core teaches students to deal with an extremely high workload and provides a foundation of exposure across STEM disciplines; while they may not remember details or learn deeply, they ultimately know how to find and (re)learn specifics when needed</td></tr>
<tr><td colspan="2">Core's Unmet Potential:
The promise of learning broadly and being inspired in Core is greater than the reality of having to take a triage approach to learning, resulting in superficial or instrumental engagement</td><td>Core's Value:
Core builds confidence, interdisciplinarity, and problem-solving capacity</td></tr>
<tr><td>HMC Mission (aspiration):
Core may or may not be the place to address leadership and societal impacts aspects</td><td>HMC Mission (aspiration):
Core should address leadership and societal impacts aspects of the mission more strongly</td><td>HMC Mission:
Students can't appreciate benefits in-situ; they need to trust in long-term benefits</td></tr>
<tr><td>Changing Core:
Faculty see many challenges, e.g., governance, oversight, faculty process/engagement, compromise vs. optimization, resources, and sustainability</td><td>Changing Core:
Students think changing Core is difficult because it's such a big part of HMC's culture and bond among students</td><td>Changing Core:
Alumni are concerned about core becoming weaker/softer and impacting value of degree and the preparation/skills of new graduates</td></tr>
</table>

As shown in Table 1, various stakeholder groups tend to agree with one another in several broad areas. All groups recognize the power and uniqueness coupled with the overwhelming nature of Core, expressed most clearly by these upper year students, and echoed by other students, including first years, and alumni (though alumni opinions differ about whether the overwhelming aspect is necessary or not):

> "I have a love-hate relationship with Core. On the one hand, it's awful and overwhelming…At the same time, I enjoyed being able to get a small glimpse of what all the disciplines do. And going through Core is a bonding experience and I feel I am much closer to my classmates."
>
> "Having such a broad foundation is good and something I value; not sure if it has to be such a terrible experience."
>
> "Being able to take classes in a bunch of different branches of STEM is super cool. I wouldn't want different majors to have different types of Core, either, because I'm glad to have gone through it with my class. But I also believe that there are ways to do it that [are] less soul crushing."
>
> "Changing Core is going to provoke outrage because of its cultural significance—it binds Mudders together with common experience and inside jokes."

Alumni largely agreed, noting:

> "Core was hell—it pushed beyond what you thought you could do. When you finish, there's no problem you can't solve…It was miserable and we complained about Core, but we couldn't have achieved what we did without it."
>
> "Being forced to take Core builds confidence."

Faculty reinforced this sense of both excellence and overwhelm in the Core from their perspective, noting that "first year students are fun to teach due to their enthusiasm…for the first half of fall," coupled with how much they value getting to know all of the incoming students. But faculty also noted a deep sadness about having "beat them down by mid-year"—the palpable loss of student enthusiasm and interest, as students give way to the overwhelming nature of the curriculum and work only "from homework set to homework set," taking a "triage" approach.

Faculty and current students also share a similar sense of disappointment at the lack of deep learning and reflection, as expressed in a faculty focus group, "what's problematic is so much gear switching and so many different tasks…deep understanding is lost"; in a discussion with first year students, "[Core is] a firehose, but are we hydrated?"; and in conversation with upper year students, "Much of core is so overwhelming that it's really hard to learn everything well." Alumni largely appreciated being "stretched" so much by the overwhelming demand. Some but not all of the alumni we spoke with recognized that today's students are "more involved," that "mental health is more important; it was always an issue, but not recognized [in the past]," and that in today's higher education climate, it is "no longer okay to wash out a third of the class."

Another shared perspective across groups addressed ways in which Core reinforces a culture and personality of extremely hard work, among students and faculty alike. Faculty commented on HMC attracting a particularly "high achieving" population dedicated to working hard (and playing hard, where play is often the same as work), with the institution as a whole both hiring and admitting "people who are

okay with asking and doing more and more…never giving things up." Faculty admitted to not modeling the kind of work-life balance that they hope for their students. At the same time, faculty were reflective about the paradox of what they ask of students: "We see only our own course, but students see all six courses." Students expressed their shared personality/identity differently, noting "we're all crazy here" with respect to their expectation of overwork, and this being "chronic to Mudd in general, but Core starts it." Alumni tended to characterize the uniqueness of "Mudders" as a challenge for admissions, "HMC isn't for everyone, not even all smart people. You have to want to be stretched, but how can we identify people who fit?" and an advantage for alumni, "Mudders cluster—older hire younger, because we know they're ready to stretch and work hard."

This characteristic tendency toward additive pursuit of workload and challenge was an explanatory factor among faculty in terms of both challenges of changing Core and unexpected consequences of recent revisions. For example, faculty in focus groups and committee discussions talked about the desire for more first year electives in the 2009 round of Core revisions, which led to a transient increase in non-STEM electives among students, but quickly gave way to most of those open units being used for "tech electives" that students now consider as essentially required pre-major work. So despite making room for electives, students are still crying out for a greater variety of courses in their first year especially, as upper year students noted, "[there's] no room for any hums"; "'taking a Hum first semester' is great advice for advisors to give to frosh."

In addition to a greater variety in types of courses, we heard a common understanding among students and faculty that there is little or no room for unexpected issues, taking care of mental/physical health, attending to competing responsibilities, participating in extracurricular activities for enjoyment, or making mistakes. An upper year student noted, "[I] didn't have time to deal with big personal issues I had 2nd and 3rd semester because laying down to cry for an hour would have taken away valuable homework time"; others responded that there is "no room for personal crisis," "you can't take a break for anything," and "all your time goes to Core with no time /energy left over for sleep, exercise, hobbies, etc." One student remarked that the reprieve is when they do a study abroad; other students cheered and laughed in agreement. Overall, faculty recognize the complexities of students having to take any time away from Core: "If a student hits a bump, it's difficult because courses are only offered once per year. If a student drops or fails a course, [they] feel bad and have to wait a whole year…there's an internal sense of stigma." Many students also commented about the mental health impacts of Core, which they felt both academically and non-academically. While faculty value students' mental health and well-being and realize that they are overworked, each department seems unwilling to reduce hours and/or homework to accommodate the mental health goal.

We will address perceptions of Core's goals and relationship with the HMC mission in depth in the next section (FEC questions 1-3 and 7). Below, in Table 2, we outline more specific strengths and weaknesses of the current Core curriculum noted in conversations with current faculty and students (alumni tended not to offer detailed comments on the current status of Core, given their variety of experiences with previous versions). The points of agreement above, and the more specific commentary in Table 2, most directly address FEC questions 4 and 5.

Table 2: Summary of Additional Strengths and Weaknesses of the Current/Recent Core, as noted during the campus visit. These specific structural, course-based, and sequencing aspects were mentioned multiple times by different stakeholders during the campus visit and represent shared opinions.

STRENGTHS	MIXED COMMENTS	WEAKNESSES
• **Tracks:** When implemented well, many students recognized the value, e.g.: "Black/gold tracks [are] an excellent idea. We all come from different backgrounds, and introductory courses are intimidating to learn if you are surrounded by people with much higher understanding coming in." • **Writ 1:** While students rarely mentioned Writ 1 (they didn't seem to consider it part of Core), faculty noted documented improvements in student writing as well as a strong and sustainable structure of faculty collaboration, sustained by the Writing Coordinator.	• **Selecting majors:** Students thought that Core represented majors better in some disciplines than others and noted a "bait and switch" phenomenon, especially in CS. Math courses "fill in gaps for other majors but don't teach enough for math majors to get a good idea." Faculty echoed these sentiments. Students also found that Engineering comes too late in Core to inform major choice. • **Sidecars:** Upper year students commented that sidecars were helpful when integrated with the course (e.g., Chemistry) and less so when they were disconnected (e.g., Mathematics).	• **Half courses:** Students and faculty note the difficulty of switching gears and having finals in the middle of the term. • **Electives (non-tech):** Students note that giving them exposure to humanities is not working as "Core is much more important than everything else." They feel pressure to fill elective units with "tech elecs" that seem to them to be required pre-major courses. • **Order of math courses:** Students are puzzled by the sequence of math topics, which does not prepare them well for first year spring physics. Faculty seem to concur.

3. CORE GOALS AND THE HMC MISSION

Given the FEC's emphasis on investigating the stated, perceived, and in-practice goals of Core and its relationship to the HMC mission (questions 1, 2, 3, and 7), we discuss these in greater depth here. The stated objectives of the Core, as published in the HMC Catalogue, are:

(1) acquisition of disciplinary knowledge and experience with discipline-related techniques,
(2) skill development in the areas of oral and written communication, critical thinking, teamwork and collaboration, project management, and/or leadership, and
(3) explorations of either the interrelationship of technical work and society or the understanding of one's own culture or other contemporary cultures.

For reference, the institutional mission states that HMC "seeks to educate engineers, scientists, and mathematicians well versed in all of these areas and in the humanities and the social sciences so that they may assume leadership in their fields with a clear understanding of the impact of their work on society."

During the campus visit, we were careful to ask about the goals, purposes, and impacts of Core in open-ended ways. When referencing the mission, we were prepared to prompt participants on the three main elements (being well-versed across disciplines; leadership; societal impact), but found universal

familiarity and readiness to comment unprompted on the relationship between the mission and the Core curriculum.

Returning to Table 1, we found strong agreement that Core does not significantly address the leadership and societal impact aspects of the mission, but relatively low agreement across stakeholder groups about the true goals of Core and whether or not Core is the right place to focus on the leadership and social dimensions of the mission. In particular, faculty viewpoints about the purposes of Core diverged significantly from the lived experience of students and alumni. The most apparent goals from perspectives of student and alumni experience are to stretch them beyond what they think they can do and provide broad exposure and enough technical knowledge across STEM fields to tackle problems and have confidence that they can find solutions. The most vivid learning in Core for students and alumni include:

- *Learning what they are capable of intellectually and technically*, e.g. "[Core] trains you to work really—almost too much—hard" (upper year student); "[Core promotes] learning to think and tackle everything" (alum).
- *Learning to prioritize and work efficiently and productively*, e.g., "[Core] teaches you how to manage time," "How did we survive so much work?" (upper year students); "I learned to be efficient, not just within Core, but managing time," "I learned to prioritize, [for example] doing homework at 3:00 AM" (alumni).
- *Learning a little bit about a wide range of STEM disciplines*, e.g., "I enjoyed being able to get a glimpse of what all the disciplines do" (upper year student); "I expected it to be an introduction to every subject early on, so you can get an idea of what you want to study more" (first year student).

Remarkably, faculty did not explicitly name the goal of "stretching beyond." The top competing goals among faculty, though their rank order varied between individuals and overall the faculty we spoke with did not convey a consensus about the relative importance of these goals, were:

a) *Providing students with a "technical toolkit" and foundation for more advanced study in STEM*. This includes various aspects of thinking and problem solving, e.g. the "ability to understand, deconstruct, and re-construct a complex system and communicate for a particular audience, with multiple practice experiences."
b) *Building interdisciplinary facility*, e.g. "Equip [students] to engage in other fields, to be conversant. If you only learn one field, you're less likely to make innovations," "See cross-disciplinary perspectives and break down silos," "[Provide an] entry point into many different disciplines [through] familiarity with language, culture, techniques, and perspectives."
c) *Inspiring students' sense of curiosity and wonder*, e.g. "What excites faculty about their disciplines."
d) *Recruiting students to the majors,* e.g., in order to maintain critical mass, and in some cases, fulfill required elements of discipline-specific accreditation (ABET, ACS).

That the goals of Core are implicit (they do not match those published in the catalogue) and not clearly prioritized (their rank order differs widely) are widely acknowledged by, and mysterious to, faculty: "Why there's no shared vision is puzzling. HMC faculty talk broadly and don't get into the weeds as a whole faculty. But then each department goes off and fills [their] boxes." This predicament may be a source of one of the main hallmarks of the Core to students and alumni—its sheer overwhelming quantity and intensiveness. A lack of clarity about the prioritization of competing goals, together with relatively independent planning and implementation of portions of the curriculum staffed by different departments,

could indeed lead to a collective impact on students that is difficult to predict and perceive. Faculty echoed key phrases from earlier Core documents several times when discussing this phenomenon—the "tragedy of the commons" and the "arms race" for student attention. Some faculty accepted these metaphors as accurate and explanatory, while others argued against them: "This narrative has become more prominent over the past 12 months. It may resonate with some, but not at all with other faculty."

We believe it is crucial to recognize the extent to which the goals that faculty articulated are in conflict with each other and with the goals that students and alumni perceive. Here are several examples of direct contradictions, among others:

- Recruiting students to the majors implies a need for similar or equal "footprints" in the Core (an analogy brought up often by faculty throughout our visit), but providing a "technical toolkit" implies an unequal distribution of time in Core; e.g., many disciplines rely on the foundation provided by Mathematics compared to other areas.
- Faculty wish for students to master tools and build a strong foundation, but mastery rarely occurs in an environment of triage and overwhelm. Despite this contradiction, the toolkit/foundation goal may come the closest to being accomplished in the long term, as students who "get through Core" tend to persist at HMC and go on to do excellent work as alumni.
- Inspiring students' curiosity and wonder is also difficult to do in an environment of overwhelm, as this kind of learning requires time for metacognition and connection-making beyond the immediate task of completing assignments.

Setting aside their actual experience, current students expressed aspirations for what they would like Core to do, some of which agree with faculty perspectives about Core goals. Students want Core to provide an exposure to the disciplines: they value the differences in approaches, methodology and the practicalities introduced by different courses. An upper year student said, "Honestly Core is one of the things that I came to Mudd for, and I'm glad I had a chance to go through Core for STEM foundation, because I would not take those if they weren't required and they all turned out to be fun and helpful;" another responded "[I'm] not sure if [Core is] fun/helpful but I think having such a broad foundation is good and something I value, not sure if it has to be such a terrible experience." Students also want Core to provide an effective introduction to the majors, especially those that are not introduced well (if at all) in high school, like computer science, engineering, sometimes physics, and mathematics as a discipline: e.g., "[the] ability to decide on majors [is] not done well; no room to explore"; "[Math] fills in gaps for other majors but they don't teach enough for math majors to get a good idea of what it is" (upper year students).

Interestingly, some of these student aspirations for Core goals align with what faculty named as inadequacies in the current curriculum—for example, faculty questioned the functionality of disciplinary exposure, "Are we really doing this? [Core is] more of a march of topics, tools, homeworks, and classes; it's compartmentalized." Faculty also note that Core does not effectively represent some majors, such as Mathematics, whose courses are focused on building skills important for other disciplines rather than introducing the discipline of mathematics. Most strikingly, perhaps, faculty perceive the "tragedy" that "students leave with a punch list of what they got through and crossed off things that they now know they hate," rather than fostering an excitement about further study.

Until HMC grapples with the contradictory nature of Core goals as articulated by faculty, students, and alumni, it will likely remain difficult to design effective revisions. Our role here is not to advocate for a

particular goal or compatible combination of goals, but we offer contrasting scenarios to provide greater clarity.

A. If *stretching students beyond what they think they can do* turns out to be one of the most important Core goals, as alumni and students already note as its most significant impact on them, then this goal needs to be stated explicitly. Then, the curriculum design can clearly enact this priority and deemphasize contradictory goals (e.g., immediate mastery of technical tools, experience of curiosity and wonder, recruitment to majors). This goal implies additional scaffolding for students in the areas of time management, prioritizing among competing demands, and dealing with less-than-ideal performance. Fostering growth mindsets and mitigating against inducing stereotype threat would also be advisable, so that HMC's highly capable students can navigate the extreme challenge with their self-efficacy intact or increased across all demographics. In this scenario, HMC faculty would gain clarity and license to implement inspiring and recruiting functions in other ways, e.g., through first-year technical electives (which is an already happening in practice for many of the majors).
B. If *recruiting to the majors and interdisciplinary exposure* turn out to be the top priorities, then a more equal footprint across disciplines in the first semester and first year are implied, along with experiences within and across courses that explicitly engage students in reflection on the applicability and meaning of their studies to them as individuals and to society, enabling a broadly thoughtful and relevant choice of major. One tradeoff in this scenario would be students' acquisition of a deep technical foundation very early on in their HMC studies, implying that some of the discipline-specific technical tools and content might be taught somewhat later, in the second year and beyond, in a less compressed way.
C. If *mastery of a shared technical toolkit as a foundation for ongoing study* at HMC and beyond turns out to be the most important goal of the Core, then the "equal footprint" concept is less important. Like scenario A, recruitment to the majors could be carried out through other aspects of student experience. Unlike scenario A, though, a focus on mastery implies giving up some specific topics and content in favor of deeper and more thorough practice, giving students the experience of applying their technical learning across an array of challenging problems with greater complexity, with more "looping" or spiraling of content to be incorporated into more nuanced problems and with varied contexts.

Whichever goals become the priority for the Core, those should form a basis for long-term modifications of the curriculum. With that clarity would also arrive a clearer path to assessing outcomes of the Core. As it currently stands, the myriad potential goals and expectations of Core are sometimes at odds with each other, making any sort of measurement of success extremely difficult, as we heard reflected in simultaneous calls from faculty for more data, and intense skepticism or dismissal of existing assessment data for not answering the right questions or doing so reliably enough. Given the divergence of viewpoints about the Core, we are not able to answer question 7, "What is our vision for the Core Curriculum moving forward?"; however, we hope this discussion elucidates the importance of a shared vision for any future actions, and we discuss below ideas about pathways toward improvements.

4. PATHWAYS FORWARD FOR THE CORE CURRICULUM

The FEC's interest in next steps is expressed in questions 6: "Given the goals and constraints, what are some pathways we could explore to improve our Core?". As mentioned above, we find that greater clarity and agreement on the top one or two mutually compatible goal(s) of Core are crucial, and discussions to that end need to be mindful of the tendency to burden the Core with fulfilling goals that are fundamentally

contradictory. HMC will give itself the best chance of successful revision or redesign with goals that are compatible and possible to fulfill with this limited portion of students' curricular experience.

However, it is not necessary to delay creative and forward-thinking action until there is complete clarity and agreement about goals. Indeed, that could postpone action for too long and force decisions about goals in the absence of new data that could productively inform the discussion. We suggest the opposite, in fact: loosening the hold on implementing small change and pilots, so that the full scope of faculty creativity and innovative thinking can emerge and feed into new ideas and discoveries among colleagues. Borrowing a concept from engineering, is there a way to allow for some form of "rapid prototyping" within Core, so that faculty receive more immediate feedback before committing to long-term, codified changes?

We make this recommendation based on a strong theme of general impasse that arose in our discussions with faculty during the campus visit—individually, in focus groups, and in committees. They often noted a recurring cycle of faculty working hard on positive, incremental changes to solve specific problems in Core, and then not being able to move them forward. In some cases, the faculty working on solutions could not obtain agreement from their colleagues across departments; in others, they could not engage colleagues deeply enough to move forward on formal decisions. Examples include multiple "patch and improve" attempts since 2009; proposed changes to Mathematics, consideration of which were postponed; and other examples of "a lot of time spent on small change solutions" that did not ultimately come to pass, or larger solutions, such as a "four-course model," that "get proposed every five to eight years" and are never adopted. Committees also talked about presentations that were made to the faculty at large, but they noted the limited time for engagement and inability to bring those discussions to action. Often, faculty became demoralized and disengaged as a result of these failures. In the words of faculty:

> "Our institutional organizational history shows we're not good at this. How can committees check back in effectively with the rest of the faculty?"
>
> "Departmental representatives [on committees and working groups] are under pressure to make decisions in the department's interest. They have to go back and explain their actions. It's asking a lot."
>
> "Everyone has their favorite things. Who decides what's valuable in a discipline? Is it the discipline's home department that decides, or should that be collective? How can we listen to and respect each other's views?"
>
> "Half courses are an example of trying to fit everyone's ideas from the faculty. It's a fragmented idea of learning at college."
>
> "Departments are playing defense. If things get cut, [departments] just pour all the same work and content into the remaining slice that they have; no one ever gives up or removes anything. Everyone always needs more."

At many institutions, committees are often more territorial and defensive than creative locations for problem-solving and innovation. However, there are ways around this phenomenon, including looking to alternative forms of interaction and approaches to experimentation. For example, what would it take to agree on a set of conditions for small changes in the Core that would not require the consensus of the full faculty, but could allow pilots to proceed and help inform longer-term changes? E.g., could faculty be free

to experiment with Core changes that have clearly stated goals, ways to assess effectiveness (even if informally—not everything needs to be a major research project), the same Core footprint in terms of timing and units, no increase student time commitment (combination of in class and out-of-class work), no more than a 20% change in the amount of or specific content of a course, draw on research-based methods for teaching and learning—or some combination thereof? There are myriad examples in the educational research literature of course and curriculum changes emphasizing mastery, in which less content is "covered," but students perform as well or better in the redesigned experience—even on content not explicitly taught—and with increased sense of belonging, interest, and/or curiosity. Such examples can be difficult to believe when they come from other institutions. Perhaps finding ways to try new approaches, allay fears, and calm the narratives that fuel the sense of impasse would help HMC move the Core forward.

Core may also benefit from non-committee venues in which faculty could share results of their teaching experiences, feel acknowledged for their engagement through their colleagues' participation, and have more open-ended, curiosity-based discussions where there are no high-stakes decisions to be made. Faculty shared with us that Tuesdays and Thursdays at 11:00 AM are reserved for faculty meetings, but most of the dates are released (and immediately filled with individual or departmental tasks and meetings) once the official faculty meeting schedule is published. What if two or three of the non-meeting times per semester were reserved for faculty seminars or roundtables about teaching in the Core, with a mix of internal talks about experiments and pilots, and external guests who could inform HMC's innovations with related research and evidence, help HMC envision new possibilities, and bring creative ideas to the task of evaluating impact? In our experience, even a small but positive and qualitatively new style of interaction such as this, on matters that are clearly important to the faculty, can shift the dynamic and create a positive feedback loop. While committee-based decisions will never become easy or simple, and serious departmental needs and resources must ultimately be considered, doing so with a broader shared experience of innovation and progress can create momentum, even if not overnight.

Two other organizational aspects for consideration in HMC's next steps for the Core were emphasized across many of our conversations with faculty: (1) the importance of the Core director and ways to increase the coordination and accountability provided by this role on campus, and (2) the importance of sustainability in planning changes to the Core, coupled with the current context of change and growth. Both of these themes were brought up independently from, and in comparison to, Writ 1, and occurred in focus groups, individual conversations, and committee discussions during the visit.

As mentioned earlier, faculty perceive Writ 1 as a "shining success" of the 2009 Core revisions. They were quick to add, though, that Writ 1 is a unique example of curricular change being well-resourced and staffed for sustainability, including the following characteristics:

- Dedicated coordinator role with adequate time to provide strong administrative and pedagogical oversight of the course.
- Ongoing training of faculty, annually before the fall semester each year.
- Frequent communication among faculty teaching Writ 1 through regular lunchtime meetings.
- Quick feedback and problem solving: the coordinator brings issues to the attention of faculty, who can make decisions and change approaches to address concerns within the same term when possible, or implement solutions for subsequent semesters.

Faculty noted that the Core director's role is more complex and difficult, including the challenging staffing issues for Core courses across all areas, which put the director in contact with a variety of departmental pressures and demands (e.g., the need to staff both major courses and core courses with limited faculty time). They pointed out that coordinating exam times alone is a large operation, yet, they noted that the Core director's time is more limited than the Writ 1 coordinator's. Faculty expressed throughout the visit that a Core director with more administrative time, or additional support staff, could provide closer monitoring, greater accountability, enhanced coordination, the ability to address issues in real time, and more tailored feedback to faculty in the Core. These steps, they argued, would go a long way toward alleviating purely logistical challenges and help channel the positive intentions of the faculty toward greater impact. As one focus faculty participant noted, "There are plenty of cool ideas; faculty get excited. But you have to resource it well for sustainability and build in training. This is why Writ 1 works." An enhanced Core director role might also assist with monitoring and discouraging upward creep in the collective workload for students experiencing the Core in any given semester, thereby enacting the faculty's desire for students to have a balance between academic work, life interests, and mental and physical health, which is so difficult to do when departments and faculty act independently.

Beyond these broad strokes, our role is not to advocate for or against particular changes. Yet faculty and students alike offered a variety of suggestions throughout our campus visit. We summarize the main suggestions in Table 3, and emphasize that any of these possible actions would need to be aligned with clearly prioritized goals in order to make sense or be considered with discernment.

Table 3: Specific Suggestions from Student and Faculty.

STUDENT SUGGESTIONS	FACULTY SUGGESTIONS
• Make connections between Core classes more explicit. Students often do not perceive the links and do not experience Core as a coherent curriculum. • Reduce the "overs" – overloading, overworking, and overwhelm; make room for mental health and non-tech electives. • Make good on the promise of the HMC mission in Core, including leadership and societal connections. Add "an ethics class first semester to teach us to consider societal impact." • Provide a realistic introduction to all majors, including introducing Engineering earlier on. • Decide on Core goals: students sense discrepancies between stated and enacted goals and wonder what HMC wants them to learn.	• Provide stronger coordination and oversight through an enhanced Core director role. • Add some mathematics back into the Core. • Consider different models: e.g., four-courses per semester; "equal footprint" for each department or major. • Consider addressing leadership and societal impact aspects of the mission outside of Core. • Implement a better-resourced version of "integrative experience," either inside or outside of Core. • Consider Core together with other aspects of the curriculum and co-curriculum, so that solutions represent a true optimization and not just a "local optimum." • Agree on what a "unit" means in terms of time and workload.

5. CLOSING THOUGHTS

In addition to the myriad perspectives and suggestions above—those from Core stakeholders (faculty, students, and alumni) and us—we note that HMC is in the midst of a number of important changes. These changes have an impact on the context in which discussion about the Core will proceed, and we think it advisable to pay special attention to dimensions of change that are especially difficult to articulate and discuss. These concerns came up less frequently during our campus visit, but were particularly "charged" (with a mix of fear, resentment, disagreement, or other strong feelings) when they did:

- *Growth and staffing*: Faculty mentioned HMC's plans for enrollment growth several times, often coupled with uncertainty about where and when additional planned faculty lines will be allocated. They mentioned that stress is already present with regard to staffing existing courses, for both HMC students and cross-registrants from the Claremont Consortium. They discussed the difficulty of "holding the line" on small section and class sizes, which they believe to be beneficial, in the face of staffing pressures. Students also noticed which courses were taught by adjunct faculty, and wondered if those subjects are somehow less important at HMC. If not addressed, growth and staffing concerns may lie just beneath the surface in conversations about Core and other aspects of curriculum; if these concerns can be allayed or clarified, it may facilitate more productive conversation and action.
- *Increasing diversity*: Faculty also pointed out that HMC's student body has changed demographically in recent years, with female enrollments increasing over the past decade, and greater racial and ethnic diversity increasing more recently. Several expressed a concern that changes in the strength and nature of students' overall high school background (which they noted are present for institutions across higher education, not just at HMC) are being conflated with, and in some cases blamed on, increased diversity. Students, too, appreciate that their prior experience plays a large role in their Core experience; as first year students put it, "high school background dictates time spent in Core" and "coming to Mudd, I quickly realized how many gaps I had." One insightful faculty observation noted that the ideal is for HMC's teaching and curriculum to help all students learn, with disproportionately positive impact on women, underrepresented minorities, and first generation college students, but that Core currently does the opposite—it is difficult for everyone, but disproportionately so for those very same groups. We suggest that issues surrounding increased diversity, like those related to growth and staffing, might implicitly inform Core discussions in unhelpful ways until they are addressed and discussed openly. Ideally, such discussions would allow faculty to confront new ideas with minimal defensiveness and maximum curiosity and openness, and would allow for low-stakes exploration rather than happening only in the context of high-stakes decisions.

All of this said, we wish to strongly emphasize in closing how very unique and important HMC's Core is, and how many outstanding benefits it confers to students, faculty, and the institution as a whole. From the summer after their first year through their post-graduate experiences, current and former students gain a remarkable set of scientific, mathematical, and engineering skills and ways of thinking, which they apply with innovation across their careers. Participants in the visit lauded the Core's "time release benefits," "shared experience [in terms of] space, curriculum and community," "foundation for self-instruction post-HMC," and even how it allows faculty to continue to grow and learn through teaching new types of courses, such as Writ 1. We have rarely encountered an institution so passionate about its curriculum, students, and collective purpose; this strong base for collaboration will no doubt support HMC through the next phase of development for its distinctive Core curriculum.

APPENDIX A. CORE BACKGROUND MATERIALS FROM HMC

1. **Structure of the Core Curriculum**

   A. Catalog Description of Core Curriculum and requirements
   B. Core Curriculum Flowchart
   C. Core Context
   D. Core Companion Guide

2. **Background**

   A. Strategic Vision Curriculum Implementation Committee (SVCIC) Report to the Faculty (2009)
   B. Writing Course Subcommittee Interim Report to the Faculty (2009)
   C. Program Review of the Core Curriculum (2011)

3. **Evaluation**

   A. Engineering ABET Program Review (2015)
   B. Math Program Review (2016)
   C. Physics Program Review (2015)
   D. Biology Self-Study (2014)
   E. Chemistry Department Program Review (2015)

4. **Appendices**

   A. The Wabash Report (2016)
   B. SVCIC Update (2010)
   C. Writ 1 Update (2010)
   D. Assessment and Accreditation Committee Report on the Core Executive Summary, Prepared by the Faculty Executive Committee (date unknown)

APPENDIX B. SCHEDULE OF CONSULTANTS' VISIT

8:00 - 8:50 AM	Tom Donnelly, *Professor of Physics and Core Currciculum Director*
9:00 - 9:50 AM	Meet with Jeff Groves, *Professor of Literature and Dean of the Faculty*
10:00 - 10:50 AM	Concurrent Focus Groups with Faculty and Students
11:00 - 11:50 AM	Concurrent Focus Groups with Faculty and Students
12:15 - 1:00 PM	Lunch with First Year Students
1:45 - 2:15PM	Department Chairs and Deans (DCC)
2:15 - 2:45 PM	Conference Call with Alumni Association Board of Governors (AABOG) members
2:45 - 3:45 PM	Core Curriculum Working Group
3:45 - 4:15 PM	Mark Ashley, *Registrar and Assistant Vice President for Student Information Management* Jon Jacobsen*, Professor of Mathematics and Vice President for Student Affairs* Lori Bassman*, Professor of Engineering and Associate Dean for Academic Affairs*
4:15 - 5:00 PM	Wrap up with Faculty Executive Committee (FEC) and Dagan Karp, *Associate Professor of Mathematics and Associate Dean for Diversity*

[1] Prior to her work as Founding Director of the Center for Teaching, Learning, and Outreach at Caltech, Dr. Cassandra Volpe Horii was involved in reforming and supporting core/general education curricula at both Harvard and Curry College. She serves on the Council for Undergraduate Education at Caltech, where, with the Vice Provost and Undergraduate Dean's Offices, she has begun regular convening of faculty teaching in the Core to discuss student data and educational practices—a project recently awarded a mini-grant from the AAU. She has consulted and facilitated workshops/discussions on STEM education, curriculum development, assessment, and/or educational development topics at Harvard, Tokyo Institute of Technology, University of Tokyo, Berea College, University of Michigan, Xavier University, and Endicott College. Dr. Horii is President-elect of the POD Network in Higher Education. https://www.teachlearn.caltech.edu/about/cassandrahorii

[2] Dr. Jennifer Weaver serves as the Assistant Director for Instructional Practice and Technology at the Caltech Center for Teaching, Learning, and Outreach. She brings to this project her expertise in active learning, technology, course and curriculum design, and faculty educational development. At Caltech, among other key contributions, she has been instrumental in launching short courses for faculty and expanding the Certificate of Practice in University Teaching program; she also works directly with many of the Core faculty and TAs, as well as training students to serve as learning liaisons to the faculty and as peer tutors in the Core and other courses. At Berkeley, she helped developed the Faculty Learning Program (NSF WIDER grant).
https://www.teachlearn.caltech.edu/about/Staff/jenniferweaver

HARVEY MUDD COLLEGE

Gap Analysis: Experience and Priority
Students and Alumni
September 2017

STUDENTS

ITEM	Often Exp	High Priority	GAP
Covering a lot of content	86.53%	23.26%	63.27%
Sharing a common experience with my classmates	84.18%	52.66%	31.52%
Sharing a common experience with all Mudders	59.68%	35.80%	23.88%
Exposure to a wide range of STEM disciplines	85.67%	69.58%	16.09%
Learning more than just "the basics" in a wide array of STEM disciplines	56.45%	50.90%	5.55%
Other	70.00%	66.67%	3.33%
Exploring ideas that were new to you	67.06%	66.56%	0.50%
Learning what you are capable of intellectually	52.19%	53.07%	-0.88%
Learning how to manage time	66.86%	68.10%	-1.24%
Preparing for study in your choice of major	40.40%	44.58%	-4.18%
Learning to think like a practitioner of each discipline represented in Core	30.09%	35.35%	-5.26%
Being challenged to do your best work	63.66%	71.30%	-7.64%
Learning to work collaboratively	65.01%	77.91%	-12.90%
Applying facts, theories, or methods to practical problems or in new situations	59.31%	72.29%	-12.98%
Learning to evaluate and interpret information	61.21%	75.23%	-14.02%
Building a "technical toolkit" that is a foundation for more advanced study in STEM	**63.90%**	**78.61%**	**-14.71%**
Meeting/learning about people different than me	31.37%	46.45%	-15.08%
Accepting that mistakes are part of the learning process	59.30%	78.15%	-18.85%
Learning to think like a humanist, social scientist or artist	9.46%	30.51%	-21.05%
Learning to cross disciplinary boundaries	**45.27%**	**68.37%**	**-23.10%**
Developing writing skills	24.07%	47.29%	-23.22%
Developing a sense of belonging to a STEM community	41.82%	65.88%	-24.06%
Developing the ability to think critically	64.18%	89.12%	-24.94%
Learning to discern relevant and reliable information to support an argument	40.52%	65.56%	-25.04%
Finding what you want to do in life	20.64%	46.79%	-26.15%
Promoting life-long learning	35.09%	65.95%	-30.86%
Developing leadership skills	7.80%	40.24%	-32.44%
Developing public speaking/presentation skills	11.46%	46.39%	-34.93%
Gaining self-confidence	19.48%	55.96%	-36.48%
Developing a sense of curiosity and wonder	**26.74%**	**70.03%**	**-43.29%**
Understanding the impact of scientific work on society	21.45%	69.53%	-48.08%
Understanding the moral and ethical implications underlying my work	15.28%	65.68%	-50.40%
Having time to reflect on material covered in each of the courses	9.48%	65.45%	-55.97%

HARVEY MUDD COLLEGE

Gap Analysis: Experience and Priority
Students and Alumni
September 2017

ALUMNI

ITEM	Often Exp	High Priority	GAP
Covering a lot of content	84.52%	25.98%	58.54%
Sharing a common experience with all Mudders	68.16%	47.51%	20.65%
Sharing a common experience with my classmates	86.57%	66.19%	20.38%
Preparing for study in your choice of major	58.19%	40.20%	17.99%
Learning more than just "the basics" in a wide array of STEM disciplines	64.10%	54.31%	9.79%
Learning what you are capable of intellectually	64.75%	56.41%	8.34%
Exposure to a wide range of STEM disciplines	86.99%	79.80%	7.19%
Exploring ideas that were new to you	66.38%	65.81%	0.57%
Learning how to manage time	63.78%	64.76%	-0.98%
Learning to think like a practitioner of each discipline represented in Core	33.28%	34.44%	-1.16%
Being challenged to do your best work	70.73%	72.77%	-2.04%
Developing a sense of belonging to a STEM community	50.80%	54.39%	-3.59%
Other	74.62%	78.67%	-4.05%
Finding what you want to do in life	26.23%	30.68%	-4.45%
Building a "technical toolkit" that is a foundation for more advanced study in STEM	**75.99%**	**82.52%**	**-6.53%**
Learning to think like a humanist, social scientist or artist	12.35%	22.40%	-10.05%
Meeting/learning about people different than me	25.14%	37.44%	-12.30%
Accepting that mistakes are part of the learning process	52.33%	64.79%	-12.46%
Learning to cross disciplinary boundaries	**57.38%**	**70.31%**	**-12.93%**
Promoting life-long learning	47.88%	63.12%	-15.24%
Gaining self-confidence	29.75%	45.25%	-15.50%
Applying facts, theories, or methods to practical problems or in new situations	60.40%	77.15%	-16.75%
Learning to evaluate and interpret information	67.00%	84.56%	-17.56%
Learning to work collaboratively	49.75%	68.07%	-18.32%
Developing the ability to think critically	72.84%	92.83%	-19.99%
Developing a sense of curiosity and wonder	**35.87%**	**57.91%**	**-22.04%**
Developing leadership skills	8.31%	33.78%	-25.47%
Developing writing skills	25.02%	53.37%	-28.35%
Having time to reflect on material covered in each of the courses	10.95%	40.44%	-29.49%
Learning to discern relevant and reliable information to support an argument	46.63%	77.11%	-30.48%
Developing public speaking/presentation skills	12.52%	44.33%	-31.81%
Understanding the impact of scientific work on society	25.42%	61.47%	-36.05%
Understanding the moral and ethical implications underlying my work	17.71%	58.82%	-41.11%

Memo
September 18, 2017
From: Ran Libeskind-Hadas, on behalf of the HMC Core Review Planning Team
To: HMC Department Chairs

The Core Review Planning Team would like to ask your department to discuss the following questions regarding your department's core offerings and the offerings of other departments. Please discuss these items within your department. *By Friday, October 13*, we'd like for each department to send us a one- or two-page response to these questions that will be shared with faculty and the visiting committee (send to ran@cs.hmc.edu). I will also follow-up with each department chair in early October to ask if you would like for a member of CRPT to meet with you, your department, or representatives of your department to hear more about your responses to these questions.

1. In thinking about your department's core offerings, how much of a priority are each of the following?
    a. communicating important "big ideas" from your discipline that every Mudder should know whether or not they will use it in their other Mudd courses?
    b. providing service to other departments and majors?
    c. preparing students for your own major program(s)?
    d. providing concrete technical skills that are transferable to students' professional lives?
    e. giving students a sense of what professionals do in your field?
    f. addressing the social context and implications of work in your field?
    g. Others?

2. If you did not have to take into account the needs/wants of other departments, what topics/skills would your department cover in the core?

3. What knowledge, skills and experience do you expect
    a. students in your core courses to have seen/acquired from other departments' core offerings?
    b. your majors to have seen/acquired from other departments' core offerings?

4. Are there topics or subjects that are currently not taught in the core that you think belong in the core curriculum? Are there topics that are currently taught that you feel could or should be omitted from the core? These topics need not necessarily be in your discipline.