

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

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## 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.

<b>KEY</b>	High agreement	Medium agreement	Low agreement

<b>FACULTY</b>	<b>STUDENTS</b>	<b>ALUMNI</b>
<b>Love-hate relationship with Core:</b>		
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		
<b>HMC Culture and Core:</b>		
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		
<b>HMC Mission and Core (current status):</b>		
Core largely does not address the leadership and societal impact aspects of the mission, except in small or scattered ways, in certain courses		
<b>FACULTY</b>	<b>STUDENTS</b>	<b>ALUMNI</b>
<b>Core Goals:</b>	<b>Core Goals:</b>	
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	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	
<b>Core’s Unmet Potential:</b>		<b>Core’s Value:</b>
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		Core builds confidence, interdisciplinarity, and problem-solving capacity
<b>HMC Mission (aspiration):</b>	<b>HMC Mission (aspiration):</b>	<b>HMC Mission:</b>
Core may or may not be the place to address leadership and societal impacts aspects	Core should address leadership and societal impacts aspects of the mission more strongly	Students can’t appreciate benefits in-situ; they need to trust in long-term benefits
<b>Changing Core:</b>	<b>Changing Core:</b>	<b>Changing Core:</b>
Faculty see many challenges, e.g., governance, oversight, faculty process/engagement, compromise vs. optimization, resources, and sustainability	Students think changing Core is difficult because it’s such a big part of HMC’s culture and bond among students	Alumni are concerned about core becoming weaker/softer and impacting value of degree and the preparation/skills of new graduates

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 2<sup>nd</sup> and 3<sup>rd</sup> 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
<ul style="list-style-type: none"> <li>• <b>Tracks:</b> 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.”</li> <li>• <b>Writ 1:</b> 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.</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Selecting majors:</b> 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.</li> <li>• <b>Sidecars:</b> 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).</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Half courses:</b> Students and faculty note the difficulty of switching gears and having finals in the middle of the term.</li> <li>• <b>Electives (non-tech):</b> 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 elects” that seem to them to be required pre-major courses.</li> <li>• <b>Order of math courses:</b> Students are puzzled by the sequence of math topics, which does not prepare them well for first year spring physics. Faculty seem to concur.</li> </ul>

### 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
<ul style="list-style-type: none"> <li>• Make connections between Core classes more explicit. Students often do not perceive the links and do not experience Core as a coherent curriculum.</li> <li>• Reduce the “overs” – overloading, overworking, and overwhelm; make room for mental health and non-tech electives.</li> <li>• 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.”</li> <li>• Provide a realistic introduction to all majors, including introducing Engineering earlier on.</li> <li>• Decide on Core goals: students sense discrepancies between stated and enacted goals and wonder what HMC wants them to learn.</li> </ul>	<ul style="list-style-type: none"> <li>• Provide stronger coordination and oversight through an enhanced Core director role.</li> <li>• Add some mathematics back into the Core.</li> <li>• Consider different models: e.g., four-courses per semester; “equal footprint” for each department or major.</li> <li>• Consider addressing leadership and societal impact aspects of the mission outside of Core.</li> <li>• Implement a better-resourced version of “integrative experience,” either inside or outside of Core.</li> <li>• 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.”</li> <li>• Agree on what a “unit” means in terms of time and workload.</li> </ul>

## 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, <i>Professor of Physics and Core Curriculum Director</i>
9:00 - 9:50 AM	Meet with Jeff Groves, <i>Professor of Literature and Dean of the Faculty</i>
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, <i>Registrar and Assistant Vice President for Student Information Management</i> Jon Jacobsen, <i>Professor of Mathematics and Vice President for Student Affairs</i> Lori Bassman, <i>Professor of Engineering and Associate Dean for Academic Affairs</i>
4:15 - 5:00 PM	Wrap up with Faculty Executive Committee (FEC) and Dagan Karp, <i>Associate Professor of Mathematics and Associate Dean for Diversity</i>

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<sup>1</sup> 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>

<sup>2</sup> 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>