HARVEY MUDD COLLEGE

Educational Effectiveness Review

Report to the
Western Association of Schools and Colleges
Accrediting Commission for Senior Colleges and Universities
December 2010

THE HARVEY MUDD COLLEGE MISSION

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.

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I. HMC'S APPROACH TO THE EDUCATIONAL EFFECTIVENESS REVIEW (EER)

This document describes Harvey Mudd College's Educational Effectiveness Review (EER), the third phase of the Western Association of Schools and Colleges (WASC) accreditation process. We begin by discussing the background, history, and context of both the college and WASC accreditation. We then report on the three focus areas of our EER: evaluating the senior capstone experience ("Essay 1: Experiential Learning"); understanding and supporting campus diversity, particularly in the context of our common core ("Essay 2: Diversity at the College"); and examining our assessment methods, practices, and results by discussing the assessment of the new core and of the departmental learning goals ("Essay 3: Assessment"). We conclude this document with a reflection on the accreditation process itself.

A. Structure and Context for the EER

Harvey Mudd College (HMC) is the nation's foremost liberal arts college of engineering, science, and mathematics. Our Mission Statement inspires us to offer students a broad and interdisciplinary education:

> *Harvey Mudd College 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.*

HMC's November 2007 Institutional Proposal describes the academic and social principles upon which the college was founded and the context in which the college's Mission Statement remains the framework by which the academic, co-curricular and administrative elements of the college are defined. The Institutional Proposal also summarizes how the HMC curriculum, divided into the three components of the Common Core, the academic Major, and the Humanities, Social Sciences, and the Arts Program, honors the mission of the college. The Institutional Proposal further discusses the administrative and academic governance structures in place at HMC, noting specifically the leadership provided by President Klawe, the Cabinet, the Board of Trustees and the Faculty. Additional documentation that illustrates the college's organizational structure, key institutional financial indicators, summary data (Appendix III-A), educational effectiveness indicators (Appendix III-B) and concurrent accreditation (Appendix III-C) are appended to this report.

Our 2009 Capacity and Preparatory Review (CPR) Report describes the college's then-current understanding of diversity on campus, the experiential learning curriculum (focusing on undergraduate research and clinic), and the college's efforts to assess student learning and improve our culture of assessment.

Since the CPR site visit, our faculty, administration, staff, and students have worked together to engage in the data collection, self-study and assessment processes described in the 2009 CPR Report and recommended in the subsequent Commission Action Letter. This EER report explains these efforts and the changes to our campus and curriculum that have resulted.

B. Overview: HMC and Core Commitment to Educational Effectiveness

As stated in the 2008 *WASC Handbook for Accreditation*, HMC is required to demonstrate "clear and appropriate educational objectives and design at the institutional and program level" and employ "processes of review, including the collection and use of data, that assure delivery of programs and learner accomplishments at a level of performance appropriate for the degree or certificate awarded."[1]

In the last year, we have followed the path described in our CPR Report, as influenced by the recommendations of our Commission Action Letter. We have engaged the majority of the college community along this journey, collecting, analyzing, and discussing data, and then deciding together how to best move forward. The purpose of this report is to describe this journey, providing context and motivation for what we have done and summaries of what we have learned in relation to our accreditation themes: experiential learning, diversity, and assessment of student learning. This report and its appended materials demonstrate HMC's commitment to understanding and improving our educational effectiveness. In addition, we have an updated inventory that describes how HMC meets each of the WASC Standards and Criteria for Review (CFR) (Appendix VIII).

C. Response to the Capacity and Preparatory Review (CPR) Recommendations: Issues raised in the CPR Team Report (November 27, 2009) and Commission Action Letter (March 5, 2010)

Following our CPR site visit in October 2009 (Visiting Team's Report [November 27, 2009]), the WASC Commission's March 2010 letter made a number of recommendations to the college. In the college's letter of response, we committed to acting on each of the recommendations. The essays included in this report provide much of the context and explanation of how we have fulfilled this commitment in the last year, but here we briefly describe some of our specific actions in response to Commission recommendations.

***Recommendation #1**: Harvey Mudd College should develop a strategic, systematic, and sustained approach to continuous improvement and the assessment of student learning that includes, among other aspects, a consistent language of assessment and an explicit alignment of the college's mission, its curriculum, and institutional and program student learning outcomes.*

Actions:

HMC Assessment Committee

1. *Assessment workshop:* The Assessment Committee, Core Curriculum Director (CCD) and Associate Dean for Faculty Development have worked together to plan and conduct workshops that address issues of assessment. These are discussed in detail under *Recommendation #2*.

2. *Assessment glossary:* The Assessment Committee has developed an HMC-specific glossary of assessment terminology and methods, has distributed it to all faculty members, and has made it publicly available on the Office of Institutional Research (OIR) website for continued reference.

[1] WASC *Handbook of Accreditation* (2008), page 24

3. *Writing course assessment:* The Assessment Committee has advised and assisted the Writing Course Committee (WCC) in its ongoing efforts to assess and evaluate the new writing course. More detail on the WCC's assessment activities is provided in Essay 3 and in the WCC's January 2010 report to the faculty (Appendix IX-B). The writing course is a college-owned course (not associated with any one department), and its assessment, by nature, uses a language and methods common to the entire college.

4. *Assessment database:* The Assessment Committee is developing an electronic archive of assessment methods, documents, and data created by HMC faculty and staff members for the assessment of student learning outcomes in both academic and co-curricular programs.

5. *Assessment Committee's ongoing role:* To move assessment from being an episodic activity in response to the occasional external stimulus to becoming a predictable process of institutional engagement, starting in 2011 the Assessment Committee will become the steering committee for future accreditation reviews. It will take responsibility for coordinating and integrating the day-to-day and year-to-year activities that are both part of our accreditation cycle and part of a healthy and functional feedback process.

Assessment in the Core Curriculum

6. *New core curriculum assessment:* The Strategic Vision Curriculum Implementation Committee (SVCIC) presented a report to the faculty on January 28, 2010 (Appendix IX-A), detailing assessment plans for the new core curriculum; Essay 3 details assessment efforts related specifically to the new core curriculum.

Assessment in the Disciplines

7. *Chemistry assessment:* As described in Essay 2, the Chemistry Department completed a study of students' academic performance in Chemistry 22 (Chem 22), disaggregating the data by gender both before and after the course format switched from the "big lecture" (about 180 students) to smaller (thirty person) classes. Format changes for Chem 22 were implemented in the spring 2006 semester. No significant changes in GPA were evident for either men or women. Additional detail of the Chemistry Department's assessment of this course's structural format changes is provided in their 2009-10 assessment report (Appendix VI-B).

8. *Capstone assessment:* As described in Essay 1, we assessed the capstone experience in three departments—Chemistry, Biology, and Computer Science—at the conclusion of the spring 2010 semester. An assessment rubric (Appendix VII-D) was used to evaluate the senior research projects of Chemistry and Biology students, and a similar rubric (Appendix VII-E) was used to assess the clinic projects of Computer Science students. Additional detail of the evaluators' findings from the capstone assessment projects can be found in the reports submitted by Nancy Hamlett (Biology, Appendix VII-A), Roman de Jesus (Chemistry, Appendix VII-B), and Christine Alvarado and Z Sweedyk (Computer Science, Appendix VII-C).

9. *Departmental assessment plans:* The Assistant Vice President for Institutional Research (AVPIR) has, for the past eighteen months, worked closely with departments to plan and implement annual departmental assessments of student learning. Each department submitted its 2009-10 assessment reports to the Dean of Faculty in fall 2010; these reports can be found

in Appendix VI. In addition, the AVPIR and chairs of each department are collaborating on departmental assessment plans for the 2010-11 academic year (Essay 3).

***Recommendation #2**: Academic departments should move beyond the first steps already taken in their developing learning assessment plans, for example, making clear their data needs and who will be responsible for analysis and decision-making.*

Actions:

HMC Assessment Committee

1. *Interdepartmental presentations:* At the December 10, 2009 faculty meeting, the chairs of two academic departments presented to their colleagues concrete examples of how the programmatic assessment of student learning outcomes is being conducted in their respective departments. Specifically, the Engineering chair explained his department's annual Assessment and Evaluation Program (AEP) which assesses how well students are achieving specific learning outcomes that align with both departmental and ABET criteria. The Chemistry chair discussed his department's six goals, and explained how the department assesses one goal each year using rubrics, portfolios, surveys, focus groups, and nationally normalized exams.

2. *Assessment workshops and discussions:* As noted under *Recommendation #1*, the Assessment Committee, Core Curriculum Director (CCD), and Associate Dean for Faculty Development have worked together to plan and conduct workshops that address issues of assessment. In particular, an assessment workshop was held on August 26, 2010 in which twenty-seven faculty members participated. In the workshop, participants were provided with successful examples for incorporating institutional, departmental, and course goals with measurable student learning outcomes. As a result, individual faculty members made commitments to incorporate some of the discussed assessment practices in their courses starting in fall 2010.

Assessment in the Disciplines

3. *Departmental plans and the role of the AVPIR:* As noted under *Recommendation #1*, departments have collaborated with the AVPIR to identify department and program goals and measurable student-learning outcomes. The results of this collaboration are available in the goals and outcomes statements prepared by each department. The AVPIR continues to collaborate with department chairs and faculty members in identifying data necessary for effective department- and course-level assessment; in clarifying who is responsible for collecting and analyzing assessment data; and for determining who decides how the analyzed data will be used to improve student learning. For example, the AVPIR assisted the Mathematics Department in collecting and analyzing data from fall placement exams that, in turn, were used for the department's 2009–10 assessment plan. Likewise, the AVPIR conducted a series of student focus groups and collected and analyzed data from student and faculty surveys for the Humanities, Social Sciences, and the Arts Department's assessment of its advising program.

4. *Mapping course goals to departmental goals:* Faculty members have identified goals and student learning outcomes for courses in each department. Examples of the integration of goals and student learning outcomes can be found in the spring 2009, fall 2010, and spring 2011 course syllabi. The AVPIR and the Assessment Committee will continue to collaborate with the departments on articulating how course goals and outcomes can be mapped to goals

and outcomes at the department level. The Engineering Department, as part of its 2009 ABET self study, and the Computer Science Department have both created preliminary mappings of their course goals and outcomes to those of their respective departments.

5. *Annual assessment report:* Each department has submitted to the Dean of Faculty the first of what is now an annual assessment report that describes how specific student learning outcomes were measured and assessed during the 2009–10 academic year. These reports summarize for each department:

    a. The questions and/or issues that were addressed in the 2009–10 assessment cycle;
    b. The individuals who were the focus of the assessment questions;
    c. The assessment methods used;
    d. The analysis and summary of the data;
    e. Based on this analysis, the actions to be taken to improve learning, engagement, and interest;
    f. The description of plans for follow-up studies;
    g. Any other observations.

6. *Assessment workload:* Departmental workloads were minimally impacted by the assessment of the capstone experiences. The Computer Science faculty members evaluating the clinic reports were compensated with summer salary, and the Biology and Chemistry thesis evaluators were paid external reviewers.

Core Curriculum

7. *Writing course assessment:* A formal assessment of the new writing course (Appendix IX-C) was completed in spring 2010 by Wendy Menefee-Libey, the Director of Learning Programs, and external evaluators (see Essay 3).

***Recommendation #3**: The college should assess the impact of the co-curriculum on student learning.*

Actions:

1. *Office of the Dean of Students (ODS) goals and outcomes developed:* In response to the recommendation made by the WASC visiting team, the ODS held a retreat in February 2010 to develop a preliminary draft of goals and outcomes, which the office did not previously have.
2. *ODS program review:* In spring 2010, the ODS began a program review. Preliminary results will be available for the team during their site visit.

3. *Study abroad assessment:* Since 2007, the Study Abroad office, which is part of the ODS, has administered a survey each year to all students who participate in the Study Abroad Program. Students who have returned from study abroad are asked to provide feedback on the academic content of their programs, the extent to which the study abroad experience supplemented their major studies at HMC, their progress (if relevant) in learning a foreign language, and their experiences with a new culture, on-site housing, and student life at the host institution.

4. *Writing center annual assessment:* The writing center and its affiliated Academic Excellence Program, which are part of the Office of the Dean of Faculty, regularly assess the quality and

impact of their programming offered to students. Assessment results, goals, and objectives for subsequent semesters are outlined in annual reports for both the Writing Center and the Academic Excellence program.

***Recommendation #4**: The college should ensure that its capstone experiences make students systematically aware of the impact of engineering and science on societal issues.*

Actions:

1. *Capstone (Clinic Program) assessment in the Engineering Department:* The Engineering Department is in the planning stages of revising its Clinic Program assessment and is aiming to increase the attention to societal impact. Clinic students have always presented the societal impacts of their projects during fall semester. Project liaisons assess the quality of the projects, and the Clinic Advisory Committee (CAC) periodically reviews the program. The Engineering Clinic Director and Associate Clinic Director are reviewing these current processes and practices and are discussing revisions, including the possible development of faculty and student surveys.

2. *Capstone assessment in Computer Science, Biology, and Chemistry:* As noted under *Recommendation #1*, part of the Computer Science, Biology, and Chemistry 2010 capstone assessment was to measure if and how students considered the societal impact of their research projects. As a result of these assessments, these departments are taking steps to more fully address societal impact in their capstone experiences (see Essay 1).

***Recommendation #5**: The college should develop a more effective governance structure and decision-making process for information technology.*

Actions:

1. *Computing and Information Services (CIS) assessment:* HMC's Chief Information Officer (CIO) is committed to the continued assessment of the college's IT governance model and decision-making practices, and has identified governance as one of four key parts of IT strategy for HMC (see http://www5.hmc.edu/strategy10/ITStrategyDraft10.pdf and http://www5.hmc.edu/ITPlanning/). The IT Strategy document identifies governance as an institutional issue that is not limited to the management of the central IT department.

2. *Development of IT Governance Model:* In Fall 2010, the CIO will propose a new IT Governance Model to the Computing Committee and the President's Cabinet. The model will address IT decision making, policy creation and project portfolio management.

3. *Coordination of IT decision making:* The CIO has been raising awareness of the issues and building consensus regarding the need for coordinated IT decision making at both the institutional level and throughout The Claremont Colleges.

4. *CIO reports:* The CIO now makes regular written progress reports to the HMC community about CIS and IT issues in general.

5. *Computing Committee:* The Computing Committee charge was updated in 2008. This committee consists of three faculty members from different departments, the CIO (ex

officio), and a student member (ex officio). As the Faculty Notebook states, the role of this committee is:

a. To represent faculty and student computing interests;
b. To advise the CIO on computing policies and on long-range planning for IT;
c. To advise the faculty and college leadership about IT needs, policies, and long-range planning.

***Recommendation #6**: The college should comprehensively analyze, articulate, promote, and assess the benefits of a diverse learning community.*

Actions:

Curriculum

1. *Core performance study extended to major courses:* Having documented academic performance gaps among different student cohorts in the core, we extended our study to the majors and found that the gaps persist into some of the major courses (see Essay 2).

2. *Faculty discussions on diversity:* During summer and fall 2010, the Dean of Faculty met with HMC faculty members in small groups to discuss the findings of the data analysis conducted to look at academic performance gaps in the major and in the core curriculum. A similar presentation to the Educational Planning Committee of HMC's Board of Trustees occurred in fall 2010. These meetings provided additional opportunities for members of the HMC community to openly discuss issues pertaining to diversity and the curriculum and to more clearly articulate our motivation to further diversify our campus (see Essay 2).

3. *Chemistry study on small versus large lecture format:* As noted above, the Chemistry Department completed a study of students' academic performance in Chem 22, disaggregating the data by gender both before and after the course format switched from a "big lecture" format to smaller class sections (see *Recommendation #1*, response 7).

4. *Physics 24 enrichment workshop:* Between the fall and spring semesters of the 2009–10 academic year, a four-day enrichment program was run for students entering Physics 24, a course that stood out in the past decade as having large disparities between the academic performance of men and women. Students were asked to voluntarily participate in the enrichment program based on low placement scores for the course. The results of the enrichment program were markedly positive, as both men and women who participated did significantly better in the course than did a comparison group. These results are discussed in more detail in Essay 2.

Advising

5. *Restructuring of the Office of Academic Affairs (OAA)*: In January 2010, the faculty voted to approve the recommendations of the SVCIC, which called for a redefinition of the role of the Associate Dean for Academic Affairs (ADAA) and the creation of the Core Curriculum Director (CCD) position. The new ADAA has an even more student-centered job description.

6. *Creation of first-year advising handbook:* The college created an ad-hoc committee on first-year advising. The committee's report and proposal, A Model for First-Year Advising, was

presented at the February 2010 faculty meeting and approved by faculty vote. Key elements include:

a. The identification of First-Year Faculty Advisors (FYAs) during the summer prior to a first-year student's matriculation and the provision for an ongoing advisor/advisee relationship with the FYA until the declaration of a major in the third or fourth semester;
b. The dissemination of first-year academic advising responsibilities throughout the faculty, with the expectation that all faculty without an impinging sabbatical will normally participate as FYAs;
c. The provision for ongoing annual training of all advisors;
d. The creation of a common framework for early advisor/advisee contact;
e. The development of structures, involving small numbers of volunteer advisors, for advising regarding first-year electives and during Orientation/Registration; and
f. The responsibility for oversight and assessment of the First-Year Advising program by the ADAA.

7. *New first-year advising system:* As of fall 2010, the new advising system for first-year students is in place, as outlined in the first-year advising handbook described above. The new system apportions the first-year class over most of the current faculty, thus allowing more attention for each student. Central to this advising model are student mentors, returning HMC students who serve as a first line of consultation with new students regarding academic issues at HMC. Student mentors provide assistance to students with personal and/or academic difficulties, and they act as liaisons for new students with various student services at HMC and within The Claremont Colleges. We will assess this revised model of advising over the coming semesters.

Admission

8. *Analysis of pre-college preparation and admission/success:* During the past year, the Office of Institutional Research (OIR) created a database that captures various metrics from student admission files. In order to understand the type and breadth of math and science education HMC applicants received prior to college, the following data were extracted from admission files for entering students in fall 2006, 2007, and 2008:

a. Demographics: gender, race/ethnicity, native language, citizenship, and parents' education level;
b. Geographic information: home city and state, and high school from which they graduated;
c. Standardized test scores (e.g., SAT, SAT II Math, and ACT);
d. AP courses completed and scores received;
e. Highest level of math completed;
f. College courses completed during high school;
g. Application status (admitted/denied).

In fall 2010, the AVPIR worked with two Claremont Graduate University (CGU) graduate students to analyze these data and to learn more about how and to what extent high-school math and science preparation predicted a student's academic success at HMC. This analysis is slated to be completed in fall 2010, and it will be available to the visiting team at the time of the EER site visit in March 2011.

Co-curricular programming

9. *Keynote speakers focus on diversity:* President Maria Klawe, Dean of Faculty Robert Cave, and alumnus David Uminsky were the keynote speakers at the college's fall 2010 convocation. All three speakers focused their comments on the diverse learning community at HMC.

10. *Faculty workshops on campus climate:* During fall 2010, the college is implementing a series of faculty workshops that focus on issues of diversity in academic and co-curricular settings, and the campus climate for underrepresented groups. The first of these workshops, entitled "Faculty Forum on Enhancing Student Diversity," was held in October 2010. The workshops use videos of conversations with past students to enable faculty members to better understand the experiences of the students and to continue developing mechanisms to facilitate a more inclusive HMC.

11. *Summer Institute:* The Summer Institute continues to be a key component in preparing students for the academic rigor of HMC. The Summer Institute is open to incoming first-year students and is designed to help ensure the academic and personal success of those who participate. While the program targets students who are underrepresented in science, math, and engineering programs, including women, first-generation students, and students of color, participation is not limited to these groups. Funds have been raised to expand this program starting in summer 2011. This new Foundations of Academic Excellence Program is currently being designed.

12. *Student Enrichment Workshops:* Our discussions over the past year have prompted more thinking about additional means for student support. Several departments, including Physics, Mathematics, and Chemistry, are offering problem-based workshops or short courses offered either pre-semester or during the semester that deliver additional help and support to students (see Essay 2).

Recommendation #7*: The college should continue to develop innovative approaches for attracting and retaining underrepresented minority students, faculty, staff, administrators, and board of trustees.*

Actions:

1. *Core and major courses performance study:* As noted under *Recommendation #6*, we extended the original study of academic performance gaps among different student cohorts (e.g., gender, race/ethnicity, and socioeconomic status) in the core curriculum to include an exploration of similar gaps that were shown to also exist in students' academic performance within the majors.

2. *Core curriculum revision:* As described in the CPR Report, one of the primary objectives of the revision of the core curriculum was to allow students greater flexibility in their course schedules during their first semesters at HMC. Based on data gathered during and subsequent to our strategic planning exercises, this flexibility aims to increase student satisfaction and, subsequently, retention and graduation rates. In coordination with the OIR and the Assessment Committee, the Core Curriculum Director will focus on the extent to which the new core allows students to adjust their academic load in their first year at HMC and have increased flexibility to either take elective courses or reduce their course load during the first year to allow greater opportunity for success and satisfaction. The SVCIC's 2010 report to

the faculty (Appendix IX-A) includes a five-year assessment plan, the timing of which will allow for a thorough evaluation of the revised core's impact on student satisfaction, as well as on retention and graduation rates.

3. *Physics 24 enrichment workshop:* As noted under *Recommendation #6*, between semesters in 2009–10 and before Physics 24 started in the spring, the Physics Department offered a voluntary four-day enrichment workshop. Workshop participants subsequently performed well in Physics 24. These results are discussed in more detail in Essay 2.

4. *Faculty hiring guidelines encourage diversity:* The faculty hiring guidelines developed by the Strategic Vision Diversity Task Force were incorporated into the Faculty Notebook in spring 2010. Those guidelines require that we now advertise in significantly more diverse venues then we did previously, and our recent hires suggest that our approach is already helping us to build diversity in the faculty.

5. *President's Circle of Advisors:* The President's African American Advisory Circle was created in 2010-11 to advise the president and college leadership on efforts to increase the participation of African-American students at HMC and in STEM careers more generally. The group will also discuss strategies for recruiting African-American faculty. The President's African American Advisory Circle will meet on campus once each year. The college plans to establish a number of Advisory Circles over the next few years, including ones focusing on women, Hispanics and globalization.

6. *Mentoring programs*: One of the ways that the college is responding to the needs of its students is by designing a new mentoring program. Alumni from underrepresented groups have reported that they felt isolated while attending HMC and that they benefitted or could have benefitted from mentoring. The new mentoring program would be open to all students, but students from historically underrepresented groups or who feel underprepared would be encouraged to participate. Faculty, staff and alumni mentors would be matched up with a student mentee to provide emotional and psychosocial support and academic and career advice. The goal of the program is to improve student morale, retention, and graduation rates. The program will be launched during academic year 2011-12; mentor training and evaluation mechanisms are in the process of being developed.

Recommendation #8: *The college should continue to examine issues about faculty and student workload to promote balance in personal and professional life.*

Actions:

Faculty and Staff

1. *Mellon Foundation workshop:* HMC is a partner in a Mellon Foundation grant awarded to a group of twenty-three colleges across the country. This grant was given to help institutions address issues of faculty professional and personal development. In February 2010, a team of four HMC faculty members attended the Mellon 23 Assembly where "Faculty Lives" was a central sub-theme chosen for discussion by eight of the twenty-one participating institutions (including HMC). The HMC team's goal was to bring the issue of balanced and sustainable faculty lives back to the college for discussion and action.

2. *FEC-led faculty discussions on workload:* As a result of the Mellon 23 Assembly described above, the Faculty Executive Committee (FEC) convened a series of special faculty meetings

beginning in September 2010 to discuss issues pertaining to work-life balance. A white paper prepared in advance of the first meeting outlined the need for HMC faculty members to collectively consider this issue, noting that:

a. Our strategic plan seeks to support the "whole person;"
b. HMC faculty members know work-life tensions exist, but have modified work behavior to avoid addressing the issue head on;
c. The introduction of increased electivity in the student curriculum should prompt us to now address faculty choices about balancing work and personal life;
d. Both internal factors (e.g., larger than anticipated classes, unfilled faculty positions, greater participation in summer research, etc.) and external developments (e.g., increased electronic accessibility) have impacted our professional and personal lives.

Since these discussions have begun, many faculty members have shared their concerns about this topic and urged the FEC to pursue further discussions and actions. The FEC is also exploring a variety of mechanisms for devising solutions to the most critical issues identified by faculty and will outline a strategy for moving forward in the coming months.

Students

3. *Enhancing student flexibility with the new core:* As noted under *Recommendation #7*, one of the primary objectives of the revision of the core curriculum was to allow students greater flexibility in their course schedules during their first year at HMC, including a possible reduction in course load. The five-year assessment plan of the revised core will evaluate, among other things, the core's impact on student satisfaction and workload.

***Recommendation #9**: The institution should give full consideration to potential leveraging of endowment through a prudent increase in debt levels*

Action:

Discussions about debt with the President, Cabinet, and Board of Trustees: Both the President and the Cabinet have discussed this issue. In addition, the Board of Trustees Budget Committee and Investment Committee both formally considered this issue. The Board of Trustees is currently examining the use of debt for partial financing of the Teaching and Learning Building and will make a decision at its meeting at the end of January. The college has traditionally been committed to low debt and at present the Board still endorses this position.

***Recommendation #10**: The college should address the lack of redundancy in critical functions in order to better serve students; the college should also seek optimal use of consortial operations to better serve students.*

Actions:

1. *Student accounts improvement:* Since our October 2009 site visit, a considerable amount of work has been done to ensure the redundancy of core functions in several areas of student services, particularly in student accounts. The college has hired a new Director of Finance who provides back up for the Student Accounts Manager. The college's Assistant Vice President of Business Affairs Assistant Treasurer, Scott Martin, serves as the secondary back up for student accounts. The college's new Campus Life Coordinator and the Administrative Assistant for Student Affairs have now been authorized to update meal plan changes for

students and address related questions. The Assistant Vice President for Facilities & Maintenance works cooperatively with the Accounts Office to respond to inquiries related to dorm damages.

2. *CUC coordination and library improvement:* The Claremont University Consortium (CUC) is hard at work to understand and improve the library system. As suggested by the Advisory Board for Library Planning (ABLP) that was formed in 2008, this is seen as perhaps the most critical issue facing the college consortium at present and will help redefine how faculty, students, and administration are connected to consortial decisions. HMC has taken a leadership role in bringing the library to the attention of the consortium. Through the Intercollegiate Faculty Council (IFC), HMC was centrally involved in the creation and leadership of the ABLP; Professor Bill Alves from the Humanities, Social Sciences, and the Arts Department has served as both committee member and chair of the ABLP.

D. Approach to the EER in Relation to the CPR

HMC's CPR Report described the basis for assessment of student learning in the capstone experience (CPR, Essay 1); a study and survey of diversity on campus (CPR, Essay 2); and improved assessment planning and implementation, particularly as this relates to our core and departmental curricula (CPR, Essay 3). This EER report mirrors the CPR Report, summarizing our activities and findings in each of these areas: Essay 1 probes our experiential learning curriculum through an assessment of student learning in our capstone experience (clinic and thesis projects); Essay 2 explains our study of gender- and race-based performance gaps in our core and departmental curriculum, relates what we have learned from the study, and describes some of the changes that have resulted; and Essay 3 describes how the college has matured in its use and understanding of assessment, as demonstrated by the comprehensive assessment of our new writing curriculum and the assessment of goals and student learning outcomes undertaken by each department during the last year. We have also included an updated inventory describing how the college meets each of the WASC Standards and CFRs (Appendix VIII).

E. Evidence of Campus-wide Engagement in the Accreditation Process

As described in HMC's CPR Report and this report, the college's engagement in the three-part accreditation process continues to involve representatives from faculty, staff, administration, students, and the Board of Trustees.

- *2006 Strategic Plan*: The college's ambitious Strategic Planning efforts commenced in fall 2006 and culminated in an intensive, four-day campus-wide conversation that involved the participation of more than 400 faculty, staff, students and members of the larger Claremont community. Distilled directly from the conversations and forums presented during this intensive Strategic Planning were the two institutional themes of Diversity and Experiential Learning, upon which HMC has based its Capacity and Preparatory Review and Educational Effectiveness Review.
- *WASC Steering Committee*: The WASC Steering Committee was appointed by the Dean of Faculty in March 2006 with the charge of planning for and drafting the college's Institutional Proposal. The Steering Committee continues to provide oversight and management of the college's accreditation review; it is currently comprised of the Dean of Faculty, the Dean of Students, the Chair of the Faculty, one faculty member who serves as Associate Dean, three faculty members representing different academic departments, and the Assistant Vice President for Institutional Research.

- *Faculty Involvement & Reports to the Faculty*: A great deal of work has occurred in the last year that has shifted the curricular and co-curricular emphasis of the college and that is both relevant to and affected by the WASC review. In January 2010 the Strategic Vision Curriculum Implementation Committee (SVCIC) gave a report to the faculty (Appendix IX-A) which described the most comprehensive changes to our core curriculum that have been made in a generation. Part of the revised core is a writing course, which has now been piloted and assessed. These results were presented to the faculty in the Writing Committee Report (Appendix IX-B). The Associate Dean for Academic Affairs (ADAA) and a number of faculty committees created the First Year Advising Report, and a new Faculty Advising Handbook has been created to reflect the revised core curriculum and new models for advising. In addition, through faculty action, the position of ADAA was redefined and the position of Core Curriculum Director (CCD) was created (ADAA Re-org and CCD Creation).
- *Faculty committees:* Faculty involvement in accreditation-related activities has also occurred through work on committees and within each department. It is fair to say that nearly every one of our 82 faculty members has been involved in some aspects of the efforts described in this report. For example, a list of faculty committees that have had significant involvement includes the WASC Steering Committee, Faculty Executive Committee (FEC), Core Curriculum Advisory Committee (CCAC), Department Chairs Committee (DCC), Strategic Vision Core Implementation Committee (SVCIC), Assessment Committee, ad-hoc Committee on First-year Advising, and Teaching and Learning Committee (TLC). Additionally, administrative faculty positions such as the Core Curriculum Director (CCD), Associate Dean for Academic Affairs (ADAA), Associate Dean for Undergraduate Research and Diversity, and Associate Dean for Faculty Development have been heavily involved. A complete list of all committees and members is included in Appendix II.
- *Program Reviews*: Over the last two years the college has spent a great deal of time and energy reviewing our core, the foundation of our curriculum. The core curriculum was systematically studied, discussed, and modified, and assessment of some aspects has already occurred (see Essay 3). Review of department programs is also discussed in more detail in Essay 3 of this report.

Harvey Mudd College's EER report was shared with and reviewed by key groups of faculty, staff, and administrators and was presented to the faculty the week of Oct. 21, 2010, followed by a weeklong comment period that included three one-hour meeting sessions.

For this third phase of the accreditation process, HMC's EER report demonstrates the college's commitment to educational effectiveness by exploring how we have:

1. Thoroughly reviewed and described our college's efforts to evaluate the effectiveness of educational programs, paying special attention to HMC's program review process;
2. Examined institutional practices for evaluating student learning and developed and implemented institution-appropriate practices for using educational results to improve the process of teaching and learning;
3. Examined the alignment of institutional resources with activities designed to achieve the institution's educational objectives;

4. Reviewed, discussed, promoted, and sustained a strong sense of institutional engagement with issues of educational effectiveness consistent with Commission Standards.[2]

This EER report demonstrates that Harvey Mudd College "evidences clear and appropriate educational objectives and design at the institutional and program level; and employs processes of review, including the collection and use of data, that ensure delivery of programs and learner accomplishments at a level of performance appropriate for the degree or certificate awarded."[3] As demonstrated in the remainder of this document, we have engaged the issue of educational effectiveness in depth. In addition to providing evidence, assessment, and analysis of student learning, we show how this process has led to improvements in our curricula and programs. We have engaged both curricular and co-curricular programs in the ongoing process of bolstering our institutional and program learning outcomes to create a stronger, more supportive environment for student learning and engagement.

[2] WASC *Handbook of Accreditation* (2008), pg. 34

[3] WASC *Handbook of Accreditation* (2008), pg. 8

II. ENGAGEMENT AND ANALYSIS OF EDUCATIONAL EFFECTIVENESS

ESSAY 1: EXPERIENTIAL LEARNING

In our CPR Report we discussed experiential learning at the college, focusing on the capstone curriculum: research thesis or clinic. In this essay we deliver on the promise we made to "focus on understanding the educational benefits of the college's capstone experience" by discussing the results of the rubric assessments of the senior capstone in Biology, Chemistry, and Computer Science.

The visiting team's report that followed our CPR site visit recommended "that the college should ensure that its capstone experiences make students systematically aware of the impact of engineering, science, and mathematics on societal issues" (page 34). To better understand where our students are on this issue, and how they are performing generally in their thesis and clinic work, we collected data through direct, rubric assessment.

The 2010 senior theses in the Biology (Appendix VII-A) and Chemistry (Appendix VII-B) Departments and the 2010 clinic reports in the Computer Science Department (Appendix VII-C) were independently assessed. The manuscripts were scored on topics aligned with the learning goals for these reports, ranging from writing ability and mastery of the literature to the discussion of methods and results. In addition, most of the theses were scored on their discussion of the societal impact of the work and its relation to other disciplines. The following sections discuss the rubric assessment results followed by a description of the changes and future actions resulting from this evaluation.

A. Capstone Rubric Assessment Results

The year-long capstone experiences, in which each senior student participates either via a thesis or clinic project, were evaluated by at least one faculty member who was not the student's advisor. One faculty member outside of the department evaluated each Chemistry and Biology thesis using the rubric in Appendix VII-D and two Computer Science faculty members evaluated each clinic report using the rubric in Appendix VII-E, a version of the Chemistry and Biology rubric that was slightly modified to fit the nature of the clinic report. All graduating seniors in each department were evaluated – 11 in Chemistry, six in Biology, and 24 in Computer Science. The manuscripts provide direct evidence for the following subset of departmental learning outcomes and goals:

Chemistry Departmental Goals:

- Students are to understand the relationship of their project to the current literature and the broader impacts of the study.
- Students are to demonstrate that they can design and implement an experiment for a specific question, interpret the results, draw appropriate conclusions, and suggest future work. The work will employ a technique which is beyond the level of the chemistry core curriculum.
- Students will communicate their project in an oral, visual presentation and in written form.

Biology Departmental Learning Outcomes:

- Students will be able to apply the scientific process, including designing and conducting experiments and testing hypotheses.
- Students will be able to conduct research experiments that demonstrate facility with the knowledge of content, synthesis, technical proficiencies, and communication skills.
- Students will be able to write laboratory reports and their senior thesis in the standard format for scientific writing in biology.

Computer Science Departmental Learning Outcomes:

- Students will be able to clearly explain technical topics in a written document.
- Students will be able to write a collaborative project report.

In view of the departmental learning outcomes and goals, each capstone report was evaluated under the rubric topics shown in Figure 1 on a scale of 1 (poor) to 5 (outstanding). Because only one or two faculty members per department scored the capstone reports, we focus on the relative scores within a department, not between departments.

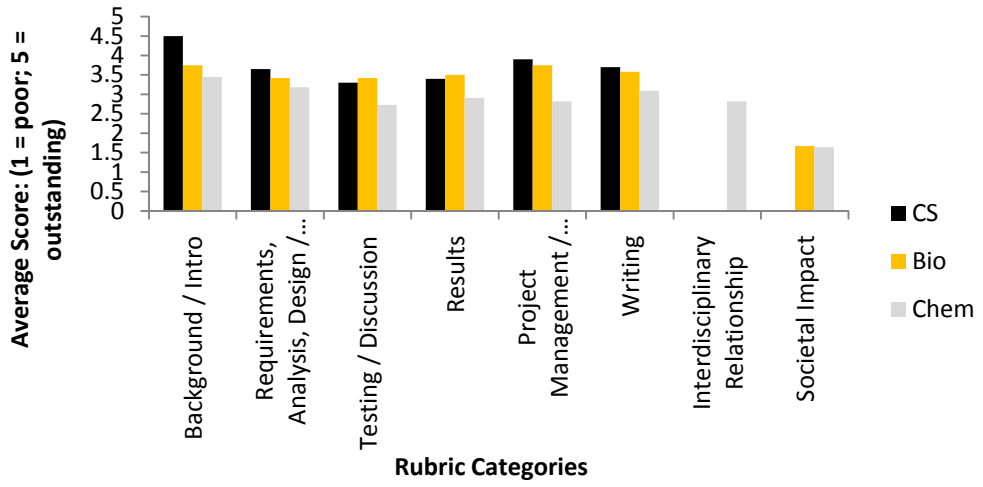


Figure 1. ***Quantitative Results of the HMC Capstone Assessment***

Of brief note is the lack of scores under the *Interdisciplinary Relationship* and *Societal Impact* categories. Historically, it has not been required that clinic reports address societal impact and interdisciplinary relationships of the work. Having gone through this assessment of capstone experiences, this now appears as a shortcoming. In the future, Computer Science clinic reports will specifically address these issues. The reviewer of the Biology theses noted that none of 2010's biology senior theses were interdisciplinary in nature; consequently they were not rated for *Interdisciplinary Relationship*.

Although all other categories earned average scores between 2.5 and 4.5, *Societal Impact* was a clear outlier, earning an average score of about 1.5. While, as one reviewer noted, Harvey Mudd students generally agree that the Harvey Mudd curriculum gives them "a clear understanding of the impact of their work on society," the students did not make that evident in their capstone reports. The following section addresses this issue in addition to describing the other strengths and weaknesses found in the reports and the future actions that aim to bolster these areas of improvement.

B. Capstone Report Strengths and Weaknesses

The specific written results of the 2010 capstone rubric assessment provide a deeper understanding of how the students are succeeding in achieving the departmental learning outcomes while also offering a guide for future directions of improvement. Table 1 summarizes the strengths and weaknesses found by the four reviewers, organized by capstone rubric topic. As a result of this assessment, each department has chosen to implement future actions and changes described after Table 1. Average scores of the Biology theses for the first six topics ranged from 3.4 to 3.8, and were less than 3 for only one thesis. No significant difference was found among the first six topic scores ($p>0.95$, Friedman test), indicating no particular areas of weakness.

Rubric Category	Strengths	Weaknesses
Background/ Intro	• Introductions showed understanding of the background and literature and showed how the study contributed to the field. (Chemistry) • Very good introduction sections used goals and hypotheses. (Chemistry) • Students were effective in describing the high-level problem, background and context. (Computer Science)	• In some cases, the introduction gave too much background information and lacked the technical information to aid in understanding the study. (Chemistry)
Requirements, Analysis, Design / Methods	• Overall, the students were above average in their analyses of data. (Chemistry)	• Often students presented a solution before presenting the problem. (Computer Science)
Testing / Discussion	• Most reports did a reasonable job describing their testing procedures. (Computer Science)	
Results	• As independent researchers, the students demonstrated their capability of interpreting data and drawing their own conclusions. (Chemistry)	• Some data was not discussed in enough detail. (Chemistry) • Most reports did not include a sufficient discussion and analysis of their results. (Computer Science)
Project Management / Scholarship	• Overall, the effort and quality was at or near graduate level. (Chemistry) • Most reports did a good job describing the project management of the project. (Computer Science)	• Only some students suggested future directions within their field of study. (Chemistry)
Writing	• Overall the students wrote at an accomplished level. (Chemistry) • Most reports used proper low-level constructs and a proper scholarly tone and voice. (Computer Science)	• Some tables and figures need to be more clear and well constructed. (Chemistry) • Some abstracts were unclear and wordy. (Chemistry) • Many reports were somewhat disorganized at a paragraph or section level. (Computer Science) • Some reports were not clear and concise. (Computer Science)
Interdisciplinary Relationship	• Some students showed a deeper understanding by bridging sub-disciplines within Chemistry, especially in the introduction section.	• The students failed to make interdisciplinary connections within the results and conclusions sections. (Chemistry)
Societal Impact		• The largest area of improvement is the broader impacts – on society and on other scientific disciplines. (Chemistry) • Only two of six theses attempted to address societal impact. None presented any analysis of the economic, social, or environmental costs and benefits of their work. (Biology)

Table 1. ***2010 Capstone Rubric Assessment: Strengths and Weaknesses***

C. Future Actions and Changes

The assessment process has revealed that, overall, students are achieving the departmental learning outcomes and producing quality work in their capstone experience. Equally illuminated are the areas in need of improvement, notably the need to address the impact of one's work on society. Each department has chosen to take the actions listed below to improve the student capstone experience and more fully achieve the departmental learning outcomes. The Biology and Chemistry Departments are also making the capstone experience the focus of their 2010-11 assessment plans.

Chemistry

- Presentation of data and information: The students will be given additional guidance in writing to effectively convey concepts and results. The department has designated formalized instruction in the construction and use of scientific tables and figures in courses preceding Chemistry 151 and 152, the senior thesis courses.

- Uniform evaluation: All evaluators will use a modified form of the current Biology Department rubric when reading theses in spring 2011. In addition, second readers will be used on at least a subset of theses in spring 2011.

- Broader impacts: The Chemistry Department has assessed the connection to broader impacts in aspects of their program other than the thesis and has found them to be strong and viable. For now, they will include a broader impacts and interdisciplinary relationship aspect in theses where it is appropriate and maintain the strong attention to broader impacts in other areas of the chemistry program, such as the focus on green chemistry principles in the general chemistry and organic laboratories, the participation in service projects in the K-12 curriculum, and involvement in global clinics.

- Assessment: The effectiveness of these changes will be assessed and reviewed during summer 2011.

Biology

- Broader impacts: The students will be guided by the advisor to include a broader impacts section in their research proposal that they submit during the fall semester of their senior thesis. This section will be similar to the broader impacts section in an NSF proposal and will include a discussion of the relationship their work has on other disciplines and society. This will accomplish the two-fold purpose of addressing the HMC Mission Statement and helping train students in grant proposal writing, an important aspect of professional practice.

Computer Science

- Report content guidelines and societal impacts: The department will develop and distribute more specific guidelines about the contents of the clinic report, which will include a discussion of societal impacts. A draft of the new guidelines is provided in the full Computer Science clinic assessment report (Appendix VII-C).

- Verification plan, testing, and metrics for success: The advisors will work with students and liaisons early in the clinic year to better define a verification plan, acceptance tests and explicit metrics for success.

- Writing: The department will offer constructive peer review and other writing workshops throughout the report writing process. These will focus on good organization and concise writing. Specifically, the reports should address the most important topics first, and paragraphs within a section should clearly support a central thesis or focus.

D. Summary of Capstone Evaluation Results and Future Directions

Harvey Mudd College students display a high level of achievement in their capstone experiences. In every case, with the notable exception of the societal impact criterion, students' thesis and clinic reports are produced with a quality that meets or exceeds all program goals and learning outcomes. The capstone experience works.

It is clear from our evaluation, however, that more emphasis needs to be put on the societal impact of students' research. The departments involved in the assessment are making the changes described to improve this area of understanding. This evaluation is also being shared with the remaining college departments to encourage additional action, particularly in addressing the societal impact of our work through the capstone experience. By making these changes, we will more nearly fulfill our Mission Statement of educating engineers, scientists, and mathematicians who not only understand the impact of their work on society but who also actively use this understanding as a context for their work and future directions.

ESSAY 2: DIVERSITY T THE COLLEGE: WHY WE CARE, WHAT WE KNOW, AND WHAT WE ARE DOING

Diversity at the college is one of the primary themes of our accreditation review. This is, of course, a very broad topic with many possible lines of approach. In the second essay of our CPR Report we took a wide-ranging look at diversity at the college and included a discussion of the preliminary results of our study of gender- and race-based performance differences in the college's core curriculum. We noted significant differences in some courses and suggested that a more detailed analysis was warranted for the EER. We have done that analysis, both deepening and broadening the study. The summary of these results is that the performance gap in the core curriculum exists, and it persists into the majors. However, at least in the case of one of the core courses where a performance gap exists, Physics 24, our analysis shows that gender differences are strongly correlated with differences in *preparation*—gender may be a proxy for background and preparation.

Beginning in the summer of 2010, the Dean of Faculty shared the results of the performance studies with small groups of faculty. These small group meetings have achieved several purposes: (1) they have enabled meaningful discussions about the studies; (2) they have been important in ensuring that the entire faculty and administration know about the results; and (3) perhaps most importantly, they have provided a venue for us to discuss the importance of diversity at the college with data in hand. The data have given us a clear impetus to address the fundamental question: "Why is diversity at the college important?" While it would be incorrect to say that following these discussions the entire community answers this question in exactly the same way and with the same priorities, a thread of commonality has appeared. Our answer to this question has nucleated around the following points, which we believe follow from the charge of our Mission Statement:

- We have always promoted diverse education to solve hard problems. A diverse population provides wider perspectives that will be needed to solve the most difficult problems.
- Being educated today means understanding the diversity of the world in which we live.
- Educating leaders means preparing them for multi-cultural, multi-ethnic environments.

While the community embraces this line of thinking, the discussion of diversity at the college is ongoing; we have made significant progress in the last few years, and we still have much to do. In this essay we provide a more detailed discussion of the study that has prompted our most recent discussions of diversity and some of the experiments in the curriculum that have followed.

A. The Study of the Core

Prompted by the WASC report in 2008, an analysis was undertaken to see whether hurdles in our curriculum exist based on gender, ethnicity, or socio-economic status (Appendix XI-E). This analysis consisted of an examination of the grades earned in the 14 graded core courses. Specifically, a step-wise regression found statistically significant effects of gender and ethnicity: men performed better than women in some lecture courses and women performed better than men in some lab courses; performance differences across ethnicity varied (CPR Report). Socio-economic status, as measured by the fraction of tuition and room and board paid, showed correlation with core course performance; however, this correlation disappeared when controlling for effects of gender, ethnicity, and incoming preparation, as measured by SAT scores. While these gaps appear to fall on lines of gender, ethnicity, and socio-economic status, studies performed since this time suggest that the performance gaps may be preparation-based instead.

Further analyses were conducted in 2009 to expand upon and repeat the first analysis. These second analyses had the advantage of an extra semester of data, as well as a more carefully constructed data file. The study was made from a pool of the 1,149 students in the cohorts of 2002 to 2008. Table 2 shows the demographics of the data pool; note that some cohorts are relatively small. These analyses regarding gender, ethnicity, and socio-economic status are discussed here.

Ethnicity	Gender		Total
	F	M	
AM (Native American)	2	6	8
AS (Asian American)	79	138	217
BL (African American)	5	11	16
HI (Hispanic/Latino)	21	59	80
NO (Foreign)	14	25	39
UN (Unknown)	55	134	189
WH (White)	199	401	600
Total	375	774	1149

Table 2. ***Demographics of the Core Curriculum Study Pool***

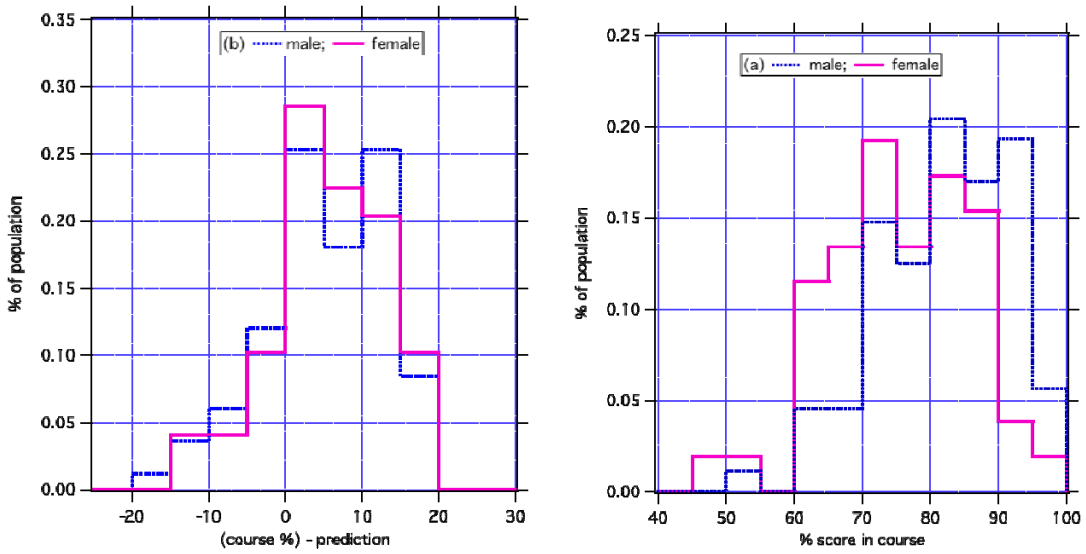
1) Gender

Gender differences in students' grades were studied first using grade-in-course as a measure of performance. Two further studies stemming from the initial findings were later performed. Of the fourteen graded core courses, women did better than men in two lab-based courses: Physics 28 and Chemistry 26, while men did better than women in three lecture courses: Engineering 59, Physics 24, and Physics 51. The extremes in the performance gaps occurred in Chemistry 26, where women's GPA minus men's GPA was 0.4, and in Physics 24, where women's GPA minus men's GPA was -0.5. We extended this study to consider major courses to determine if this gender gap persists. It does: women tend to do better in Chemistry and Biology labs and worse in Engineering and Physics lecture courses (Appendix XI-F).

The apparent gender discrepancies were observed for both Physics 24 and Physics 51, and the Physics Department undertook a study to better understand the origin of these discrepancies. While delving into underlying reasons for this discrepancy, two possibilities were initially explored: (1) the large lecture format might not be conducive to female students' learning, and (2) the gender difference might be confounded with a preparation difference. Initial studies have shown the second reason to be more compelling.

Because the Physics 24 and 51 classes are both taught in a large-lecture format, we considered the possibility that this format might be part of the reason women underperform in these courses. However, given studies run by the Chemistry Department, we suspect that this is probably not the source of the discrepancy. In 2006, Chemistry 22 changed from a large-lecture format (~180 students/lecture) to smaller lecture sizes (~30 students/lecture). When the grades of men and women are considered both before and after the lecture format change there is no discernable difference in performance. We predict that this trend would hold for physics courses.

The Physics Department looked more deeply into the apparent discrepancy in Physics 24, in which the gender-based performance gap appears largest, and considered the possibility that the performance gap was not gender based but resulted from differences in students' preparation. In 2009, nearly every student entering Physics 24 (essentially the entire freshman class) took a physics placement exam. A large number of these students were also administered the Force Concept Inventory exam, an exam that is used nationally in a pre-test/post-test fashion to assess students' knowledge of mechanics. After Physics 24 ended, the department compared each student's grade in Physics 24 to their score on the placement exams. Figure 2a shows the students' final percentage-score in Physics 24 broken out by gender; this graph makes it *appear* as though there were a gender-based difference in students' scores in the course. Although men and women perform differently in the course, Figure 2b shows that correcting for differing levels of preparation in and exposure to physics before beginning the course eliminates the gender gap. There is no statistical difference between the men's and women's scores when corrected for incoming preparation. Therefore, while we cannot determine whether gender, incoming preparation, or another confounded factor is driving the gender difference in performance in Physics 24, we are hopeful that addressing preparation gaps might mitigate the apparent gender gap.



(a) (b)

Figure 2. Performance in Physics 24. *(a) Student scores in Physics 24 (2010) broken out by gender. This figure misleadingly suggests a gender-based difference in students' performance in this course. Mean male score is 77%, mean female score is 71%. (b) Students' performance in Physics 24 (2010) corrected for scores on placement exams. A pool of 131 students is represented in this figure.*

Figure 2b was calculated by taking a student's final score in Physics 24 and then correcting it for their score on the placement exams. What this shows is that students who do more poorly on placement exams also do more poorly in the course, irrespective of the student's gender: males who score poorly on the placement exam do just as poorly in Physics 24 as do females who score poorly on the exam.

This is an important revelation for the Physics Department and the college. While it is a study of only a single course, they are compelling data. It would be enlightening to know if similar preparation gaps undergirded other performance gaps in our core. Based on these data, the college

is considering how best to move forward so that students with a somewhat weaker preparation can be "brought up to speed" before entering particular parts of the core curriculum. One pilot effort to meet this challenge is discussed below, in the *Preliminary Actions* section.

2) Ethnicity

The effect of student performance in the core as a function of ethnicity is more difficult to draw conclusions from because of the low numbers of students in some of the groups (see Table 2), but the data indicate that African Americans and Hispanics are getting lower grades than students from the other groups. This generalization, however, hides an interesting fact: Hispanic women perform as well as other women in the core, while Hispanic men do worse than other men. The underperformance of the Hispanic group, then, results from the underperformance of the Hispanic males. The analysis of ethnicity effects would likely also benefit from an analysis of preparation and ethnicity, similar to the Physics 24 study described above.

3) Ethnicity, Gender, and Socioeconomic Status

A multiple-regression analysis was performed that bins course grades into either A/B or C/D/F, combines the effects of students' gender, SAT scores, ethnicity, and socio-economic status, and then asks the question, "What is the impact of a particular variable on the likelihood that a student gets a C, D or F in a particular course?" The data indicate that correlations exist for both gender and race in receiving a low grade for some core course (Appendix XI-E). For example, African Americans do less well than white students in Chemistry 22, Hispanics do less well than white students in Physics 51.

We need to understand the origin of these differences. Are they due to preparation? Based on the data discussed in the Physics 24 study, one suspects that the gender differences may result from differences in preparation (which was not a control parameter in this query). We would like to know if this might also be true for race-based differences.

The correlation between socio-economic status and students' performance in the core was studied by dividing our students into three bins based on their financial aid needs: no-need, middling need, and high-need. It is notable that large differences were not found in the SAT math or SAT verbal scores between the three socio-economic groups. Ultimately, the SAT scores have little correlation to students' academic success at the college as measured by graduating grade point average. This may not be surprising because our students effectively saturate the high end of the SAT test, so the scores do not provide much discrimination between students admitted to the college. Further, when a multi-variable regression analysis was done, controlling for gender and ethnicity, socio-economic status did not have a significant correlation with student performance in the core.

B. Preliminary Actions

As mentioned earlier, the Dean of Faculty has met with a large fraction of the faculty in a series of small meetings (~7 faculty per meeting) to discuss the results of the study, excluding the preparation studies performed on the Physics 24 class data because that analysis was only in preliminary stages at the time. The purpose of the meetings was to promote information sharing and discussion and to get the faculty's sense of what these data mean for us and how we should respond. The "preparation versus gender-gap" results are already pointing us toward some of our next studies: Does preparation also correlate with race? What constitutes a solid preparation in a particular discipline? How can we provide an appropriate preparation to talented students who

have had less exposure to subjects in high school? While these are far-reaching questions for the institution that will be the basis for long-term, ongoing discussions and actions, we have moved forward along several axes to begin addressing the gaps that are evident from this study.

Mathematics 15

In the fall of 2009 the Mathematics Department piloted Math 9, a workshop in calculus. Every freshman at the college took this course in a one-hour slot that was freed-up in the math curriculum as the college shifted from the old core to the new core. Math 9 is designed as a workshop that emphasizes problem solving and the application of calculus to problems in the sciences, as compared to the more proof-oriented approach in the standard calculus curriculum.

This year, the piloted course is being taught as Math 15, Applications and Art of Calculus. It is the Mathematics Department's one-unit calculus refresher course, and it maintains a problem-oriented, workshop approach; the classroom environment is kept informal and there are no lectures. Three sections of 15-20 students each are run each semester, and students self-select for the course. Each section meets once a week for one hour and runs concurrently with Math 25 (calculus and linear algebra); students who take Math 15 are also enrolled in Math 25. Math 15 (and Math 9 last year) may grow into a refresher course that can help our less well-prepared students "come up to speed" in one of the college's foundational courses.

Chemistry 19

In 2009 the Chemistry Department piloted Chemistry 19 (Chem 19) a workshop-style class that ran concurrently with the freshman chemistry course, Chem 21. Students were placed into Chem 19 based on poor performance in the first half of Chem 21. The 0-unit course met for about ninety minutes a week and focused on strengthening students' background in chemistry and teaching problem solving strategies.

In 2010, the Chemistry Department administered an online exam during the summer, and students with especially weak performance were invited to enroll in Chem 19, along with Chem 21, for the fall of 2010. Other students self-selected into the course or were encouraged to enroll due to weak performance on quizzes in Chem 21. This year, students are given ½–unit of credit for each half-semester of fall enrollment. The course currently has 18 students who meet for about 90 minutes a week to identify and work on areas of weakness in their preparation to do college-level chemistry.

It is notable that in 2009 *none* of the students who took Chem 19 failed Chem 21. Chem 19, like Math 15, has the potential to grow into a refresher course that can help our less well-prepared students come up to speed in one of the college's foundational courses.

Physics 24

As noted from our study of the core curriculum, Physics 24 is a class in which weaker preparation (more often found in women and minorities in this study) correlates strongly with weaker performance. To try and address this, and to better understand the source of these difficulties, a four-day enrichment and preparation class was held over winter break for 20 students (freshmen) entering the course in the spring 2010 semester. Although the number of student participants was relatively small, and we cannot make firm statistical arguments about the workshop's success, we are heartened by the participants' ultimate performance in Physics 24.

The students in the workshop self-selected based on their scores on a placement exam administered over the previous summer; the students taking the workshop scored on the lower end of the placement exam and, based on prior years' experience, would be at risk in Physics 24.

The performance of these students in Physics 24 was tracked and compared to a similar group of students who did not attend the winter workshop. The members of the comparison group were selected to match the test scores and gender distribution of the workshop group. Both groups were then compared to the performance of the whole class.

Group	**Final exam** Ave±Stdev	Median	**Course Grade as GPA** Ave±Stdev	Median
Whole class	68 ± 16	69	2.72 ± 0.93	2.7
Workshop	64 ± 17	61	2.42 ± 0.73	2.5
Comparison	55 ± 12	53	2.05 ± 0.68	2.0

Table 3. ***Physics 24 Final Exam and Course Grade Comparisons***

The results of the workshop are notable. As can be seen in Table 3, the workshop group did much better on the final exam and final grade than the comparison group and nearly matched the whole class. We also analyzed the data by gender, as shown in Table 4. Again we see that the workshop group, both the male and the female cohorts, did significantly better than the comparison group and nearly as well the whole class. Despite this improvement, however, an overall difference between men and women persists: the men in the workshop group did better than the women in the workshop group, though both men and women in the workshop group did better than the comparison group. As discussed earlier, these data may be explained by differences in student preparation, not differences in gender.

Gender	**Group**	**Final exam** Ave ± Stdev	Median	**Grade as GPA** Ave ± Stdev	Median
Male	Whole class	72 ± 14	76	xxx	xxx
	Workshop	69 ± 14	67	2.71 ± 0.67	2.7
	Comparison	60 ± 15	63	2.33 ± 0.60	2.3
Female	Whole class	61 ± 16	60	xxx	xxx
	Workshop	59 ± 19	60	2.18 ± 0.72	2.0
	Comparison	50 ± 8	52	1.83 ± 0.67	2.0

Table 4. ***Physics 24 Students' Scores by Gender***

Figure 3 shows the performance of men and women in the workshop and comparison groups on the Physics 24 exams and the final grades. It is notable that the two midterms do not show consistent improvement by the workshop group, but by the time of the final exam significant gains are shown. We believe that this is because the workshop highlighted material from all components of the course and the cumulative effects of the enrichment, therefore, might not have been evident until all material in the course was covered (i.e., by the time of the final exam). Further, it can be seen that, by the end of the course, women in the workshop group were doing as well as men in the comparison group. In Table 5 the grade distribution for the workshop and comparison groups is shown. What is notable is that the workshop students were *three times* as likely to get A's or B's than the comparison group; conversely, the workshop group was half as likely to get a grade of C through F.

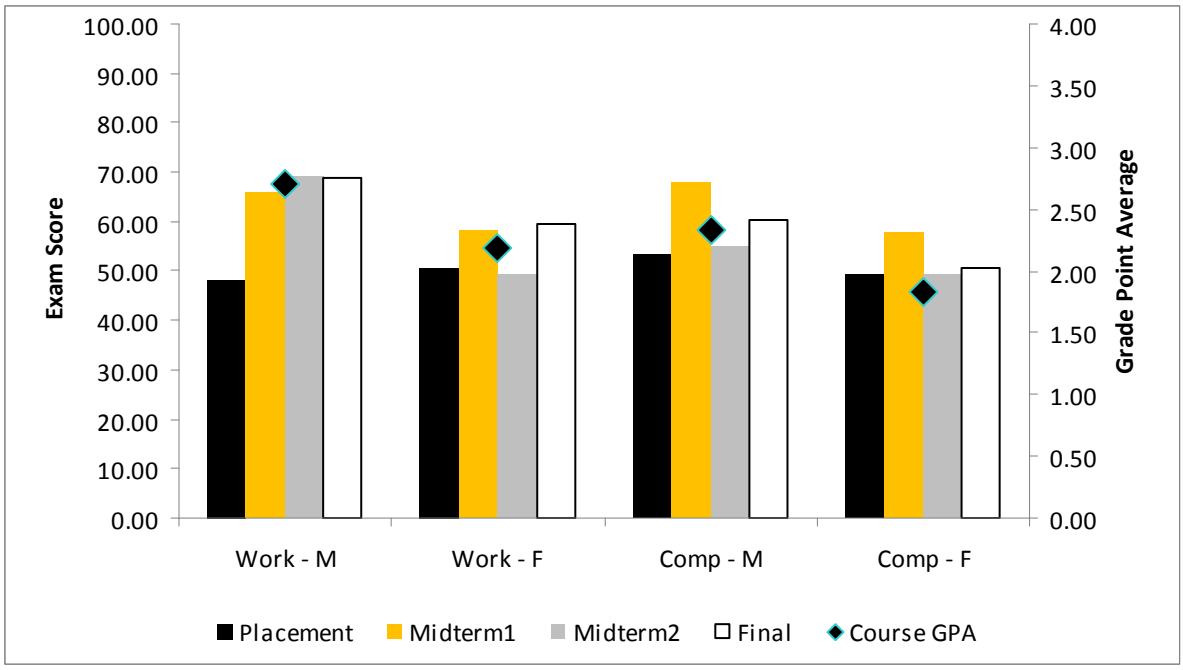


Figure 3. ***Physics 24 2010 Workshop and Comparison Scores***

Gender	Group	Number of A's and B's	Number of F's
Male	Workshop	5	0
	Comparison	2	0
Female	Workshop	4	0
	Comparison	1	1

Table 5. ***Grade Comparisons by Gender***

In summary, Physics 24 workshop participants performed better in the course than a comparison group, as judged by the boost in participants' grades relative to the comparison group. We are heartened by the outcomes of the workshop on our less well-prepared students. The results of the workshop, coupled with the new insight from the Physics 24 preparation study, suggest at least one effective way to improve the learning of some of our most prone students, male and female. Additional studies are being undertaken to verify and expand these findings. In the following section we detail future steps the college is taking to further address the issue of underperformance of students in our courses.

C. Future Steps

We have made strong progress in both analyzing the performance differences in our courses and in beginning to understand the underlying factors behind these differences. Using this knowledge, we have been empowered to take the first steps in addressing these performance differences. As we mentioned at the beginning of this section, this is an ongoing process and we are encouraged by the new understanding these studies and preliminary steps have brought. In this light, we plan

on taking the following actions to better understand and support our desire for a thriving, diverse campus.

- *Supporting the recruitment and retention of traditionally underrepresented groups:* Professor Ran Libeskind-Hadas, the Associate Dean of Faculty for Undergraduate Research and Diversity, is leading the efforts to make sure the programs and resources are in place to support our institutional goal of a more diverse student body. For example, he is leading ongoing discussions, beginning with one on October 22, 2010, that explore the resources necessary to support students who, while bright, might still have gaps in their academic preparation. The discussion groups include faculty members, Thyra Briggs and Peter Osgood from the Admissions Office, and Gary Kelly and Angelica Ibarra from the Office of Institutional Diversity.

- *Student enrichment workshops:* Many departments are considering adding problem-based workshops that run either prior to or concurrent with their core courses. As noted, the Chemistry, Mathematics, and Physics Departments have already instituted these courses and are tracking participating students' downstream performance. Some departments, including the Physics Department, are also expanding the workshop to include more students.

- *Student preparation study expanded:* Core courses exhibiting the disparity in performance across gender and ethnicity are continuing to be studied.

- *Expanded Summer Program:* Funds have been raised to expand our summer program starting in summer 2011. This Foundations of Academic Excellence Program is currently being designed and will include academic offerings for students who have weaker preparations entering the college.

ESSAY 3: ASSESSMENT: THE NEW CORE CURRICULUM & DEPARTMENTAL LEARNING GOALS

The college's move toward assessment has been gaining ground in the last decade, and has accelerated in the last five years, in part due to the arrival of new faculty who have promoted a culture shift surrounding assessment. From this grassroots move toward assessment, many faculty members have been brought on-board through participation in the accreditation process, workshops, reports, and discussions.

That assessment has increasingly been woven into the fabric of the college was emphatically demonstrated when, in the founding documents of our new core curriculum, the faculty insisted that the impact and efficacy of the new curriculum be assessed (Strategic Vision Curriculum Implementation Committee [SVCIC] report, Appendix IX-A). Additionally, each department at the college now assesses student learning outcomes that flow from departmental goals and student learning outcomes.

A major element of our new core curriculum was the development and implementation of a new writing course, including a set of assessable goals for this course (Writing Course Committee's report, 2009). In the CPR Report we promised to "begin data gathering and report on the assessment of our new core writing curriculum," and we have done so.

Methods for assessing the student learning goals of the writing course were developed through a collaboration between the SVCIC, the Assessment Committee, the OIR, and the WASC Steering Committee. We piloted versions of the new course in fall 2009, and the full curriculum is in place for the 2010-11 academic year, as promised in the CPR Report. Assessment of the pilot course was carried out last year and the results of this assessment and the curricular modifications that resulted are described here.

In parallel with this evaluation of our new writing curriculum, we noted in the CPR Report that departments were developing student learning outcomes associated with their department goals and that we were creating instruments to assess those outcomes. Results from these initial assessment efforts are also described here.

A. The Core

As noted in the CPR Report the faculty of HMC approved the revised core curriculum, the goals for which are identified in Figure 4. This section describes the implementation, staffing, and plans for assessment of this revised core curriculum. It also describes the writing course, a key element of the new curriculum, and the pilot of this course that was run in fall 2009. The assessment of this pilot course is driving the changes being made to the writing course, as described below.

Core Goal 1: Demographic trends

a. Retain and graduate a greater percentage of the students that we enroll.
b. Attract, enroll, retain, and graduate a greater percentage of students who contribute to the diversity of the college, as measured by gender, ethnicity, and socio-economic background.

Core Goal 2: Benefits from increased electivity

a. Students will be more satisfied with their ability to choose courses that satisfy their interests.
b. Students will be more satisfied with their ability to shape their own academic programs.
c. The numbers of students participating in language study during their first year will increase.
d. Students will be able to create breathing space within their first two years to accommodate academic, social, or emotional needs.

Core Goal 3: Preparation for the post-core curriculum

a. Students will be as able to achieve success in their majors as they were prior to the core reform.
b. Students will be more able to employ interdisciplinary thinking.
c. Students will be more proficient writers.

Figure 4. ***Goals for the Revised Core Curriculum***

1) Implementation and Staffing

The revised core curriculum is being fully implemented during the 2010-11 academic year. As a preliminary stage, a pilot of the writing course was run during fall 2009. The full implementation efforts were initially led by the Strategic Vision Curriculum Implementation Committee (SVCIC). However, as this committee was always intended to be a temporary committee, in January of 2010 the HMC faculty approved a new permanent position, the Core Curriculum Director (CCD), whose role is to oversee the core long-term. The CCD works in tandem with the Associate Dean of Academic Affairs (ADAA) to oversee the advising, curricula, staffing and assessment of the core. Professor Lisa Sullivan is the founding CCD and she is now directing the ongoing efforts of the revised core.

The CCD continues to work closely with academic departments, appropriate standing and ad hoc committees, and the Dean of Faculty (1) to revise and coordinate core courses, (2) to establish sustainable models for the core, (3) to prepare for the new choice labs, (4) to promote ongoing assessment activities, (5) to ensure that course scheduling is managed so as to optimize student flexibility in choosing elective courses, and (6) to consider whether the requisite funding and staffing is in place to deliver the curricular excellence to which the college aspires. At the January 2010 faculty meeting, the SVCIC reported that a pilot version of the writing course had successfully run during fall 2009 and that the key work of implementation of the revised core had become increasingly decentralized, with ownership of the new curriculum moving substantially into the hands of the departments, committees, and faculty members who have direct responsibility for its execution.

2) Assessment

The 2009 SVCIC Report articulated a set of key expectations and associated outcomes (Figure 4 above) for the new core in the areas of demographic trends, benefits from increased electivity, and preparation for the post-core curriculum. The assessment strategy of the new core is being further developed and refined and baseline data for comparison have been and are continuing to be collected. In addition, the Assessment Committee is working to hone the language and practice of assessment across departments. These efforts are described in more detail below.

Success-in-major effects: The Assessment Committee, the OIR, and the CCD are working together to prepare measures, tools, and strategies for assessing the new core. The central aim of this assessment, as requested by the faculty, is to measure the effectiveness of the core curriculum in preparing students for the major before and after implementation of the new core. Such an assessment of potential differences in preparedness between cohorts of students in the old and new system will be based on direct measurements of student learning outcomes: methods [that] "prompt students to represent or demonstrate their learning or produce work so that observers can assess how well students' texts or responses fit institutional or program-level expectations."[4] While the assessment is still under development, such methods will likely include capstone projects, exams, portfolios, juror evaluations, or pointed exam questions. For comparative purposes, these data will be collected from current students under the old core, from future students under the new core, and ideally from students of the past few years. Departments are given the responsibility for selecting the measurable item that they wish to assess; for example, the Physics Department is using the same multiple-choice questions from year-to-year to track student performance, and the Engineering Department is using their Assessment and Evaluation Program to track student progress. While the Assessment Committee has begun collecting ideas about which measures may be of use, further discussion within and with the individual departments is ongoing to develop a sustainable, non-invasive, and regular assessment schedule.

Comparison of survey data: Because some goals that the college is hoping to achieve with the new core will not be captured by measuring student learning alone, we will also compare data on student and faculty satisfaction, engagement, and development of the whole person. The college has access to survey data, including national studies by the National Survey of Student Engagement (NSSE) and the Cooperative Institutional Research Program (CIRP), in which HMC has participated for a number of years. A targeted comparison of certain survey items will yield information about, for instance, measures of students' satisfaction before and after the implementation of the new core. Two surveys conducted by CIRP – the College Senior Survey (Appendix XI-C) and Your First College Year Survey (Appendix XI-D) – include variables that will enable us to measure data, collected both before and after the integration of the new core, about students' academic and emotional self-confidence, their ability to navigate college resources for academic and co-curricular guidance, and their satisfaction with courses within specific disciplines, both at the end of a student's first year in college, and at the conclusion of their senior year. In addition, data collected from both the NSSE 2010 survey (Appendix XI-A) and FSSE 2010 survey (Appendix XI-B) will enable us to compare students' perceptions – both prior and subsequent to the implementation of the revised core – regarding academic engagement, learning styles, and overall satisfaction with their college experiences. The Assessment Committee is currently evaluating metrics to be used from these instruments for both baseline and post-core comparisons.

Honing assessment practices and language: Finally, as an underlying foundation for successful assessment, the Assessment Committee is working to hone assessment practices and language on campus. As noted earlier, we have created a glossary of common assessment terminology used at HMC and have run assessment workshops for interested faculty.

[4] Maki, Peggy. Assessing for Learning: Building a Sustainable Commitment Across the Institution. Sterling, VA: Stylus Publishing, LLP. 2004

B. Pilot study: Writing course

In this EER report, the review and analysis of campus-wide work dedicated to the assessment of the new core curriculum focuses on the writing component of the new core curriculum. The writing course has been selected (1) because it captures many of the goals of the new core curriculum, (2) because it was run as a pilot during fall 2009 and offers us a feedback cycle from which to learn, (3) because writing captures many of the critical-thinking skills we value, and (4) because improved writing proficiency by our students is a major emphasis within the new curriculum and across the majors. This section describes the implementation, assessment, and summary of the pilot writing course.

1) Implementation

Within the context of the goals of the new core curriculum, the learning goals of the new writing course were presented to the faculty in the February 2009 Writing Course Committee (WCC) report and are reiterated in Figure 5. According to the recommendations of this report, a pilot writing course was offered during fall 2009. Forty students were chosen to participate in the pilot course. These students included those who ranked the pilot writing course highly in the summer Humanities 1 (Hum 1) survey and those who did not return the survey. For the fall 2009 pilot only, students took two different writing half courses, participated in several assessment exercises, and received credit for Humanities 1 (Hum 1), the course taken by first-semester freshmen in the old core.

Course Objective: The overall course objective is to teach students effective college writing strategies and conventions as the tools for critical inquiry through specific exercises in reading, thinking, and writing.

Learning Objectives:

A. Upon completion of this course, students will be able to:
   1. Use informal writing to develop their thinking at different stages of inquiry
   2. Deploy some main elements of persuasive and expository writing (see below) in formal papers
   3. Recognize and use rhetorical purpose, voice, and audience analysis in academic reading and writing
   4. Write clear, coherently structured papers that use appropriate evidence and diction toward forceful intellectual discourse
   5. Demonstrate understanding of some of the main cross-disciplinary similarities and differences in conventions of expression and article formats
   6. Develop an effective writing process that includes repeated revision of writing
   7. Make use of the feedback process, both as reviewers and as recipients
   8. Identify passages in their writing that call for citation, attribution, or acknowledgment, and apply appropriate forms of citation where needed

B. Assignments will be designed to help students practice the following elements of persuasive and expository writing (singly or variously combined):
   1. Articulating the results of a line of inquiry
   2. Cogently defending a conclusion or point of view on a debatable topic
   3. Describing an object or process relevant to a topic of study
   4. Explaining difficult concepts
   5. Explaining why a project was or should be undertaken
   6. Synthesizing material toward a new conclusion
   7. Critiquing a scholarly paper
   8. Summarizing a body of work (for example, writing an abstract)

Figure 5. ***Writing Course Objectives***

2) Assessment

The WCC designed instruments (Appendix IX-C) to directly measure the extent to which the writing course's learning objectives were met in the pilot and to provide some means of comparison between pilot students and traditional Hum 1 students at the midpoint of the semester. Four external evaluators used direct and indirect methods to measure student mastery of the learning outcomes and to offer feedback about the course.

The four external evaluators hired to assess the students' writing had previously served as Hum 1 tutors, were familiar with the expectations for writing assignments in Hum 1, and had experience reading and evaluating first-year HMC student writing. This experience enabled them to draw comparisons between the pilot papers and the essays they had encountered in Hum 1. In January 2010 the external evaluators met with the Director of Learning Programs for a three-hour training and norming session in applying the rubrics to a set of final project essays, reflective essays, and critical reading/peer review exercises. All information that might identify an individual student was removed from the papers, and two reviewers independently evaluated each paper or exercise. The two assessment scores were then averaged.

In addition to the rubric evaluations, pilot instructors met regularly and communicated their impressions to the WCC. Students also completed custom-designed evaluations at the end of each half course and participated in focus group meetings with the WCC. As a final feedback measure, a student member of the WCC, Mark Cyffka, audited two sections of the course and wrote a report based on his experience and the comments he gathered from students.

Thirty-eight (38) of 40 students agreed to have their work used for assessment. Table 6 lists the student writing assignments used to assess the pilot course and the associated average rubric scores. The analytical and reflective essays were scored out of 32, on a scale of one to four measured along eight dimensions. A passing score on all eight dimensions would yield a score of at least 16 (basic pass). A score of at least 24 would be considered a solid pass, while a score near 32 would be considered a high pass. As can be seen in Table 6, most of the students received passing marks on these assignments. The critical reading/peer review exercises were measured on a scale of one to four along six dimensions, with a possible total score of 24 and a passing score being at least 12 (basic pass), 18 (solid pass), or 24 (high pass).

Student Assignment	Assessment Method	Average Student Score
Analytical essays	Rubric to assess objectives 3, 4, 6, and 8 (Appendix IX-C) both directly and indirectly	20 (out of 32)
Reflective essays	Rubric to assess objectives 3, 4, 6, and 8 (Appendix IX-C) both directly and indirectly	21.4 (out of 32)
Critical reading / peer review exercises	Rubric to assess objectives 3, 4, 7, and 8 (Appendix IX-C) directly	15.7 (out of 24)
Critical reading / peer review exercises (18 Hum 1 students)	Rubric to assess objectives 3, 4, 7, and 8 (Appendix IX-C) directly	14.8 (out of 24)

Table 6. ***Writing Assignments and Average Rubric Scores***

The critical reading/peer review exercise administered in the eighth week of the semester was also compared to a sampling of the same assignment completed by a group of eighteen traditional Hum 1 students at the same point in the semester. Although the results were not strikingly

different for the two classes, the eighteen Hum 1 exercises earned an average score of 14.8, compared with the pilot students' average score of 15.7.

Qualitative results from the rubric assessments reveal that additional instruction and practice in thesis development, critical evaluation, and peer review would strengthen the writing course. The external evaluators agreed that, while overall the essays produced by the pilot course students did not differ appreciably from those of the Hum 1 students, the thesis statements in pilot course papers tended to be less well developed than in Hum 1 papers. They attributed that to the fact that the pilot students had only a half-semester of revision instead of the semester-long revision and refinement process of Hum 1. Particularly on the analytical essays, average scores were below three in all categories, placing them below the solidly passing range (though still above a "basic pass"). While these assessments are consistent with early college student writing performance described in the literature, the students would benefit from additional practice and instruction in this area. The results of the critical reading/peer review exercise evaluations suggest that pilot students were at least as adept at peer review as their Hum 1 colleagues; however, the evaluators recommended that all students would benefit from additional instruction in critical evaluation of a paper and in the practice of peer review. HSA 10, the course taken in the semester following this writing course, can also use this insight to help strengthen these areas for students.

The experience of the 2009 pilot faculty (Groves, Johnson, Kuenning, Orrison, and Saeta) was uniformly positive both with respect to the experience of teaching the writing course and with respect to the level of preparation provided by training for the course. Both students and faculty feedback indicate that the 8:1 student/faculty ratio was effective in maintaining full class participation, building close interactions between the professor and students, and allowing for the timely and extensive feedback necessary for the seven-week course.

Furthermore, the feedback from the pilot experience indicates that the course will be most successful when it is clearly a course about writing rather than a disciplinary content course. While each section needs a topic and readings to generate interest and ideas, the focus of the course must be on the development of student writing rather than the delivery of content.

3) Summary

The aggregate data compiled by the external evaluators show the pilot writing course met its objectives in each category and subcategory assessed. When pilot students were compared against a cohort of traditional Hum 1 students on the critical reading/peer review exercise, pilot students performed as well as or slightly better than Hum 1 students at the semester midpoint. These results indicate that pilot students were served well by the course and that the measurable course learning objectives were realized.

The writing course has proven to be an effective introduction to writing at Harvey Mudd College. It is clear that, as was expected during the design of the new core, the writing course can only provide a foundation upon which other HMC coursework will build in order to help our students become excellent writers. In fact, the new core follows the writing course with a writing-intensive disciplinary course, Humanities, Social Sciences, and Art 10 (HSA 10), in the spring of the students' first year. Other core courses and major courses will also be able to build on this common foundation by including rich, meaningful writing experiences. As a result of the pilot study, the writing handbook chosen for the pilot, *Style: Lessons in Clarity and Grace*, (9th edition), by Joseph M. Williams, is being fully adopted by all sections of the fully implemented writing course beginning in fall 2010. The use of Williams' text will give students and faculty

across the college a common vocabulary for talking about writing; this vocabulary will help tie together student writing experiences across the curriculum.

In addition to revealing the overall effectiveness of the course content and structure, the assessment process has provided invaluable insight into areas that can be strengthened, both within the writing course and in following courses, including additional emphasis on thesis development and critical peer review and evaluation. Full implementation is currently proceeding, and the current version of the course reflects many change based on the evaluation of the pilot. The most significant change is that the course now requires students to write (and revise) only one central essay instead of two. This modification allows students to spend more time practicing thesis development before they produce a full draft, and also allows them time for multiple revisions (two revision cycles instead of just one.)

In addition, plans for training additional faculty are underway. The college is working toward establishing a pool of thirty trained faculty members who are able to teach in the writing course in some rotation determined by departments. With faculty from all departments participating in teaching the writing course, this common experience and language will unify and strengthen the writing experiences woven through our core and major courses to create a strong, coherent writing experience for our students.

C. Departmental Assessment of Student Learning Outcomes: 2009-10

In an effort to develop a more "strategic, systematic, and sustained approach to continuous improvement and the assessment of student learning"[5] and a more "consistent language of assessment and an explicit alignment of the college's mission, its curriculum, and institutional and program student learning outcomes"[6] we have undertaken a thoughtful program of assessment in each department.

As of spring 2010, all seven academic departments at HMC have documented goals that speak to both those completing coursework in the core and to those completing academic majors in the field. From these goals the faculty have also identified measurable student learning outcomes that reflect the skills, knowledge, and facility that HMC students should be able to demonstrate as a result of completing coursework in each academic department. Both the department chairs and AVPIR looked to other academic departments at peer colleges for examples of discipline-specific skills that undergraduate students should acquire.

Having identified goals and student learning outcomes for their departments, the faculty in each department now concentrates annual assessment plans on measuring student learning outcomes associated with a department goal. As noted in Table 7, which was also included in the CPR, many of the departments chose to focus their assessment activities on the pilot changes made to core courses so that they could better understand whether and how curricular changes in the core would impact students' achievement of specified learning outcomes.

[5] WASC Visiting Team Report, November 27, 2009, pg. 20

[6] WASC Visiting Team Report, November 27, 2009, pg. 18

Department	Goal Assessed in 2009-10
Biology	Assessed the extent to which the department's Senior Research Program develops students' skills in planning and carrying out independent research, data analysis, and oral and written presentation. (See Essay 1 for details.)
Chemistry	Assessed how or whether HMC students understand "how the fundamental principles of chemistry are applicable to the solution of real problems in a variety of technical fields."
Computer Science	Sampled student work, surveys and statistics to measure achievement of specific goals and student learning outcomes for CS 5, which is part of the core curriculum. Data were coded and analyzed to quantify and track student work so as to assess failure/success of student's achievement of departmental and course goals.
Engineering	Assessed students' attainment of the departmental goal of "ability to apply knowledge in math, science and engineering" by evaluating student performance in E80 – Experimental Engineering, the first-course-in-major for engineering.
Humanities, Social Sciences, and the Arts	Assessed (1) particular student learning outcomes linked to departmental goals and (2) the departmental advising system.
Mathematics	Assessed the utility of AP Calculus BC exam scores as a determinant for math placement and success in the first semester.
Physics	Assessed performance gaps in the physics core curriculum. (See Essay 2 for details.)

Table 7. ***2009-10 Assessment Reports for Academic Departments***

While detailed assessment reports completed by all of the academic departments at HMC are included in Appendix VI, we give an overview of the assessment results and findings here. Each department's assessment during the 2009-10 academic year focused on issues and goals that were of highest departmental priority. For several departments, an evaluation of new, revised, or long-standing courses offered in the core curriculum was needed in order to ensure that the course content and delivery remained appropriate in the context of the new core. The Chemistry Department, for example, revised the structure and delivery of its core course (Chem 22) in 2006, shifting away from a large lecture format to smaller classes. During the 2009-10 academic year, the Chemistry faculty agreed that more analysis of this course's ability to provide students with an understanding of the impact of chemistry on society would be most useful. This assessment provided the department with a broader understanding of how the course aligned with the larger mission of HMC and with the educational goals for the new core.

As described in detail in Essay 2, the Physics Department's analysis of student performance in the core course Physics 24 provided greater insight into observed differences in students' performance in this course, and perhaps the broader core.

The Mathematics Department investigated whether students who earned a score of five on the AP Calculus BC exam were actually more prepared for the first math core course (Math 11) than other students, and whether the AP Calculus test was a good instrument to use for math course placement in the first semester at HMC.

The Computer Science Department's assessment of their core course (CS 5) took a more macro-level view of the course's ability to give students skills, appreciation, and an enjoyment of CS as an academic discipline. For the Humanities, Social Sciences, and the Arts Department, it was agreed that a detailed assessment of the HSA advising program was most important. The faculty

acknowledged the HSA advisor's important role in helping students design a humanities, social sciences, and arts education that is meaningful to a successful HMC academic career.

Regardless of whether departments chose to focus their assessment efforts on the curricular or administrative elements of their program, a common feature of several departments' assessments was a focus on the societal impact and/or interdisciplinary role of their field. A component of the Engineering Department's regular Assessment and Evaluation Program is an evaluation of how well the department provides students with the ability to "apply knowledge in math, science, and engineering."[7] Rubric data collected for their 2009-10 assessment efforts suggested that the engineering program at HMC meets this goal within the context of their Engineering 80 course, the first course taken by students majoring in Engineering. The Computer Science Department had mixed results when evaluating students' understanding of the application and societal benefits of computation. Survey data from the Chemistry Department's assessment plan suggested that almost all students agreed strongly that they "were able to understand and address one of society's demands made upon chemistry." The Biology Department realized that their current rubric for assessing students' senior research projects did not emphasize societal impact of science and, thus, agreed to restructure the required elements of the students' fall semester research proposal to incorporate this.

The Humanities, Social Sciences, and the Arts (HSA) Department's assessment of the advising program found that students were either not clear about HSA department course or distribution requirements, or did not understand the importance of the HSA distribution requirements as a component of the larger HMC education. These findings, informative at the departmental level, were also important to the college as a whole, as it prompted the HSA department to consider the structure of HSA distribution requirements within the context of the revision of the core curriculum. The department implemented a simplified HSA distribution structure in fall 2010 in order to anticipate and address some concerns that arose in this assessment.

An additional benefit of the departments' assessment and evaluation studies was that each prompted additional questions and issues of interest for further study. For example, the Mathematics Department's assessment report stated that students who earned a five on the AP Calculus BC exam ultimately performed better on a departmental placement exam than did students who did not receive the same score. However, the department also found that almost all first-year students appeared to be weak in many calculus techniques, and that a score of 5 on the BC Calculus exam did not correlate with exam performance in a way that would justify allowing students to place out of the first math course in the core. This study has prompted the Mathematics Department to pose questions to consider further, including whether successful students who earn a five on the Calculus BC exam should receive a math core curriculum different from other students and how the department can do a better job at preparing students with essential calculus skills.

Assessment efforts that focused on departmental priorities and established goals provided momentum to continue a robust assessment schedule. As noted in Table 8, HMC's academic departments have identified questions and issues to be addressed during the 2010-11 academic year that continue to be of curricular and programmatic priority to them.

[7] Department of Engineering, *Assessment and Evaluation Program (AEP) Guidelines*, 2009, page 4.

Department	Goal To Be Assessed in 2010-11
Biology	Will assess the goals for the department's core course (Bio 52) to ensure that they are aligned with curricular content and realistic student learning outcomes.
Chemistry	Will assess the Chemistry Department's new core laboratory course, Chemistry 24 *Chemistry Laboratory*, against our departmental goal #3 "for all Harvey Mudd students to understand how chemists successfully study and interpret chemical and physical phenomena through experimental investigations including using high-quality modern instrumentation."
Computer Science	Continuing from the external assessment of the capstone projects of 2010, will study the impact of the senior capstone experience against Goal #6, "For all CS majors to demonstrate success in open-ended, student-driven investigation," and Goal #7, "For all CS majors to develop professional skills in writing, visual, and oral presentations, both in academic coursework and in open-ended clinical practice."
Engineering	Will continue with the annual implementation of the department's Assessment and Evaluation Program.
Humanities, Social Sciences, and the Arts	Will assess the efficacy of a new core curriculum course (scheduled to be piloted in Spring 2011) and the manner in which it contributes to the achievement of departmental goal #3 to "foster excellence in critical reading, thinking, and writing."
Mathematics	Will focus on: 1) identifying the essential calculus skills students need for success in the core curriculum; 2) investigating the reliability of the department's placement exam as a measure of students' mathematical aptitude; and 3) studying whether students earning a score of 5 on the AP Statistics exam is a predictor of their success in the mathematics core statistics course.
Physics	Will continue to study the performance of students in its core courses, as initiated in the department's 2009-10 assessment (see Essay 2).

Table 8. ***2010-11 Assessment Plans for Academic Departments***

III. ANALYSIS OF THE EFFECTIVENESS OF THE PROGRAM REVIEW PROCESS

A. Departmental Program Review

Following our last WASC accreditation review, which concluded in 2000, Harvey Mudd College began to construct and implement an academic program review process. Given the small number of academic programs at our college, early on we decided that a repeating sequence of a core curriculum review followed by seven departmental reviews would allow us to cover the whole of the curriculum on a regular and predictable cycle. (This cycle will begin in 2011-12.) By 2002, we had created a set of guidelines that would shape our review process; these guidelines were subsequently revised in 2007, and then again in 2008 in response to our work on our Capacity and Preparatory Review. The sequence of our program reviews is shown in Table 9.

Year of Review Completion	Program	Second Program
2002–03	Mathematics	
2003–04	Physics	
2004–05	Humanities, Social Sciences, and the Arts	
2005–06	Computer Science	
2006–07	Core	
2007–08	Core	
2008–09	Core	Engineering (ABET)[8]
2009–10	Revised-Core Implementation	Chemistry (ACS)
2010–11	Revised-Core Implementation	
2011–12	Revised-Core Implementation	
2012–13	Biology	
2013–14	Chemistry (ACS)	Mathematics
2014–15	Physics	
2015–16	Engineering (ABET)	
2016–17	Humanities, Social Sciences, and the Arts	
2017–18	Computer Science	

Table 9. ***Program Review History***

Our initial program reviews were useful to specific departments and to the institution, but it is fair to say that they also represent the beginning of an institutional learning process. As we have moved through a number of reviews, as one department has borrowed ideas and practices from a previous review, and as we have built more assessment expertise at the college over the last decade, our reviews have become more far-reaching, more oriented toward student learning outcomes, more inclusive of direct evidence, and more essential to program planning and curricular change. In Appendix IV, we address this learning process by applying metrics, that mirror the WASC 2008 Program Review Rubric, to all of the reviews completed to date in order to understand our progress. While we still have ample room to grow as far as our program review sophistication goes, we believe that Appendix IV shows that we are well on our way in moving along the rubric's scale from "Initial" to "Highly Developed."

[8] Available upon request

As evidence to suggest our increased sophistication with carrying out assessment, analyzing the assessment data, and feeding it back into our curriculum and program, we note that several recent reviews have led to substantial curricular and programmatic change. For instance,

- The Humanities, Social Sciences, and the Arts Department removed the Humanities 2 course from its curriculum and replaced it with a required HSA elective course for the first year spring semester. The department also created the position of an HSA Advising Coordinator in order to address the concerns about advising inconsistencies and the interruption of the advisor-advisee relationship due to faculty sabbaticals.

- The Computer Science Department established closer and more formal ties with Biology, as evidenced by the implementation of a joint CS/Biology course and the anticipated establishment of a joint major in Mathematical and Computational Biology.

- The Engineering Department redesigned its course in experimental technique (E80) with an emphasis on an improved and integrated series of experiments that build toward a field component. This new version is built around experiments that relate to the design, construction, and operation of launch vehicles (i.e. rockets).

- The core sequence is now scheduled in a manner that affords students greater flexibility in their class schedule during their first year of college. Students may opt to take an elective course, such as a foreign language, or may choose to lighten their academic load by taking one fewer course during the academic year.

- The laboratory components within the core have been reduced and now include an Interdisciplinary Choice Lab, which is a one-unit laboratory course that emphasizes interdisciplinary experiential learning

- The core sequence can now be completed in three semesters, as opposed to four or five semesters.

- A college-wide writing course is now in place and is taught or co-taught by faculty from all seven departments at HMC. This seven-week half-course provides explicit attention to writing fundamentals, emphasizing the value of and linkage between good writing, critical thinking, and careful reading.

- The Mathematics Department developed a Teaching & Research Postdoctoral Fellowship program. It provides an academic internship for training new PhDs to join the professoriate at liberal arts colleges. The HMC administration provided initial funding for this position that, in turn, enabled the department to leverage this experience to secure $800,000 of funding from the National Science Foundation to support five two-year postdoctoral positions for new PhDs. A total of five postdoctoral positions will be funded through this award. To date, two postdoctoral appointments have been made.

The core curriculum study, revision and implementation are nearly complete, and 2011-12 will be the first year that our new core is fully integrated into the curriculum. Our work with the core has been a time-consuming and intense effort over the last several years and, with its implementation complete and our initial assessments of the writing course complete, we will move forward in our program review cycle. The Biology Department is planning a review for 2012-13, and both the Chemistry Department and Mathematics Department reviews will occur in 2013-14. As an

example of our most recent practices in program review, we provide here a summary of our core curriculum review process.

B. Core Curriculum Program Review

Over the past four years, the faculty has focused on a programmatic review and revision of the college's core curriculum. As described in more detail in our CPR Report, and in Essay 3 of this EER report, the Strategic Vision Curriculum Committee (SVCC) was appointed in January 2007 with the task of examining the following aspects of the HMC curriculum: 1) student choice and flexibility in the first-year curriculum; 2) the core curriculum, including new roles for departments within the core, college-wide ownership of core courses, thematic and/or blended courses, and integration of the life sciences; 3) the expansion of interdisciplinary course options; 4) time for students to explore unique interests; and 5) the relationship between the curriculum and co-curricular activities, particularly as it relates to the strategic planning goal of nurturing and developing the whole person.

To carry out this charge, the SVCC examined numerous aspects of the curriculum and agreed that the core was the primary place upon which to direct the committee's broader curricular review efforts. As such, the committee employed a number of methods to understand the current structure of the core program, the content and focus of similar programs at peer institutions, and students' opinions on what they perceived as curricular priorities for their first year at college. First, the SVCC examined the curricula of sixteen institutions (including Caltech and MIT) to which HMC traditionally compares itself for benchmarking purposes and found that the core curricula of these institutions were significantly smaller in scope than was the HMC core. The committee also interviewed two HMC alumni, Scott Fraser and Kim Vandiver, who are now prominent faculty members at Caltech and MIT, respectively. Professors Fraser and Vandiver were uniquely qualified to comment on the HMC curriculum because they both had recently led core-revision efforts at their home institutions. Both professors agreed that the HMC core was too rigid and that streamlining it would afford HMC students greater electivity in choosing courses and structuring their education.

Data collected from a 2006 survey conducted by the Curriculum Committee suggested that HMC students had a strong desire to take foreign languages (82% of 331 students who responded to the survey). The previous core curriculum, which assumed that all students would take the same set of core courses in their first semester, made it difficult for students to begin or continue a foreign language. Only students who had advanced placement credit were positioned to take a language, but even then other core courses, including HMC's mathematics and HSA core courses (which met four days per week) and afternoon labs (which met for entire afternoons), tended to conflict with language courses at the other Claremont Colleges that met five days per week.

Surveys completed by 64 rising sophomores who participated in Summer Math in 2008 confirmed our students' desire for electivity in the first year. Among those surveyed, 72% would have found it valuable to have an elective in their first semester at college. Of those who saw such electivity as valuable, 35% indicated they might have used that elective to take a foreign language, 26% said they might have taken Engineering 4 or another engineering course, and the remaining students indicated interests in a wide variety of subjects in the sciences, social sciences, humanities, and arts.

The opportunity for students to have several unconstrained elective courses was critical to the college's efforts to address the Strategic Vision. The committee's careful review of the

curriculum at HMC resulted in the following curricular, programmatic and structural changes to the core:

1. The core sequence is now scheduled in a manner that affords students greater flexibility in their class schedules during their first year of college. Students may opt to take an elective course, such as a foreign language, or may choose to lighten their academic load by taking one fewer course during their first academic year.

2. Students now take a Biology course during their first year at HMC.

3. The laboratory components within the core have been reduced and now include a Choice Lab, which emphasizes interdisciplinary experiential learning.

4. Students now earn one unit of credit for physical education courses and a half unit of credit for colloquia, whereas before these were zero-unit courses.

5. The core sequence can now be completed in three semesters, as opposed to four or five semesters.

6. A new writing course that emphasizes writing across the curriculum is now being taught or co-taught by faculty from all seven departments at HMC. This seven-week half-course provides explicit attention to writing fundamentals, emphasizing the value of and linkage between good writing, critical thinking, and careful reading.

A discussion of the assessment of parts of the new core and more details about its implementation in our curriculum are provided in Essay 3. Included in Appendix IV is our analysis of how the college's 2008 Academic Review Guidelines and departmental program reviews align with the WASC Rubric on Program Review.

IV. FURTHER DEVELOPMENT OF STUDENT SUCCESS EFFORTS

This EER report details the academic and co-curricular initiatives at HMC that are structured to ensure our students' personal and academic success in college. The study of students' academic performance in the core curriculum and in the academic major (Essay 2), the ongoing analysis of admission data that may be indicative of college success and the self-study currently being completed by the Office of the Dean of Students are examples of our purposeful and careful consideration of student success at HMC.

In Appendix V-A, we provide a summary of these initiatives as well as an analysis of current enrollment, retention, and graduation rate data for both HMC students and students at peer institutions (Appendix V-B; Appendix V-C; and Appendix V-D). Similar to the patterns highlighted in HMC's CPR Report, the data suggest that the first-to-second semester retention rates of all HMC students, regardless of gender or ethnicity, remain high. Drops in enrollment are more prevalent between students' second and third years of college; this pattern was consistent for HMC students across most ethnic cohorts and for students at comparative institutions.

Our analysis of student success indicators also includes a discussion of assessment data collected from multiple national surveys conducted at HMC each year. In particular, data collected from the 2010 CIRP College Senior Survey (CSS), the 2010 CIRP Your First College Year Survey (YFCY), and the 2010 National Survey of Student Engagement (NSSE) provide us with additional insight into the degree to which our students feel academically, socially, and emotionally engaged with the college. In Appendix V-A, these data are discussed in terms of students' personal satisfaction, academic engagement, community engagement, and perception of campus climate.

V. SUSTAINABILITY OF EFFECTIVENESS PLANS

Our work in developing and implementing effective and sustainable assessment processes at HMC has included strategic investments in both personnel and faculty and staff training and development. As described in Essay 3, we have hired a doctoral student enrolled at Claremont Graduate University as a part-time assistant in the Office of Institutional Research to collect and analyze data to inform our study of admission metrics that may be predictive of students' eventual success at HMC. In addition, this student has also been instrumental in assisting academic departments at the college in collecting and analyzing data that were subsequently used for their 2009-10 department assessment reports. Our Director of Academic Operations partnered with a part-time consultant to complete the comprehensive assessment of students' performance in both the core curriculum and in courses for each major at HMC, as described in detail in Essay 2. The Dean of Faculty continues to provide funding for ongoing assessment, training, and development for faculty, as evidenced by the August 2010 workshop, and webinars sponsored by the Society for College and University Planning (SCUP)[9] and the Society for Teaching and Learning in Higher Education (STLHE)[10] in which HMC faculty and staff participated.

We believe that while these investments in both educational materials and staffing have been critical components in our successful creation of assessment practices throughout the college, these efforts have also been episodic. To maintain assessment plans that ensure the processes for evaluating student learning are sustainable throughout the next decade the Assessment Committee will assume responsibility for accreditation activities starting in 2011, and the Registrar will become more integrated in the assessment of student learning. It may also be advantageous for the college to consider additional staffing to assist in the direction and implementation of assessment at HMC.

[9] *Predictive Analytics: Building a Crystal Ball for Student Success*, September 29, 2010

[10] *Connect Learning Across Courses with Curriculum Mapping*, November 3, 2010

VI. CONCLUSION: REFLECTIONS ON WHAT WE HAVE ACCOMPLISHED

Over the past five years, we at Harvey Mudd College have worked to meet the two key goals we articulated in our 2006 accreditation proposal: to develop a better understanding of our experiential learning curriculum (Essay 1) and to understand and improve the environment so that we build a more diverse college community (Essay 2). Along the way, we have moved from displaying a nascent "culture of evidence" to routinely using assessment practices, analyzing assessment data, and feeding that analysis back into our curriculum so that we constantly improve the education of our students (Essay 1, Essay 2, and Essay 3).

In our CPR Report we described a broad self-study that generated many paths to an improved understanding of the education we provide at Harvey Mudd, and then we narrowed our focus to the topics and inquiries that we believed were most important to our college. In looking forward to the EER, we indicated that we would improve our understanding of the senior capstone experiences as a way of considering our larger commitment to experiential learning. We also promised to more fully analyze gender and ethnicity performance gaps at the college so that we could minimize them and improve our ability to attract and retain students from the broadest possible backgrounds. Further, we had just begun to implement our new core curriculum, and we promised to assess the educational effectiveness of the new writing curriculum based upon the goals and learning outcomes described in its founding documents. While the purpose of this core assessment was to tell us how well we were achieving our institutional learning goals, we also described our plans to assess student learning in each department of the college. The following is a summary of the activities and results described in this report that highlights the ways in which we have delivered on the promises made in our CPR Report.

Experiential Learning: Essay 1

We used external evaluators to conduct rubric assessments of the senior theses written by students in the Chemistry and Biology Departments. The theses were found to be very good across a wide range of topics, including analysis, discussion, and writing, but were largely found to have shortcomings with regard to explicit discussion of how the student's research played a role in larger societal issues. Based on this analysis, the Biology Department has made changes to their program, including requirements that students explicitly address broader impacts in their theses, and the Chemistry Department has recommitted to emphasizing broader impacts in the departmental curriculum.

Evaluators also undertook a rubric assessment of clinic reports in the Computer Science Department. The clinic reports were also found to be of a high quality; however, like the theses, a weakness was found in tying the clinic work to societal impacts. Based on the evaluations, the Computer Science Department has decided to make modifications to its clinic program, including the adoption of writing workshops and a requirement that societal impact issues be addressed in clinic reports.

Diversity: Essay 2

We extended our study of student performance in the core curriculum. The extended study verified our initial findings of performance gaps and demonstrated that they persisted into the majors. We have found, however, that these performance gaps do not necessarily break along the expected lines—thus our initial perception that men and women performed differently in the core

is likely a poor way of framing the analysis. A more detailed analysis shows that the performance gaps, at least in a single course, highlight differences in preparation and background rather than gender.

We believe that this is a very important result, and that its demonstration represents a new way for the college to frame its discussion of diversity. We will certainly extend the study of how preparation affects our students' performance to a wider range of courses; in the meantime, the results direct us to a constructive discussion of how best to build programs that will enrich our students' background as they enter the college. Our initial steps in this direction, and our assessments of those steps, suggest that problem-intensive workshops are a good way to close the preparation gap. We are also in the process of gathering resources for running an academic summer enrichment program, the Foundations of Academic Excellence Program, and placing entering students into faculty research programs so that they will have close mentorship from their first days on campus.

We are excited about the new insights our studies have revealed, the development and piloting of a variety of workshop courses, and the possibilities of an extended enrichment curriculum in the near future.

Student Learning: Essay 3

We have reviewed the new writing course, a cornerstone of our revised core curriculum. We piloted the writing course in the fall of 2009 and undertook a detailed assessment. The aggregate data compiled by the external evaluators showed that the writing course met its objectives in each category and subcategory assessed. When pilot students were compared, for example, against a cohort of traditional Hum 1 students on the critical reading/peer review exercise, pilot students performed as well as or slightly better than Hum 1 students at the semester midpoint. These results indicate that pilot students were served well by the course and that the measurable course learning objectives were realized. Every student in the college now takes this course as part of their first-year fall curriculum.

Additionally, every department now assesses some aspect of student learning, as tied to departmental goals, every year. Initial results of these departmental assessments, and resulting changes to programming, are described in this essay. A program of assessment for the coming year is also detailed. Finally, we have grown in the sophistication of our program reviews, as is clear from our study and assessment of the new core curriculum, and we have established a cycle for program reviews that extends to 2017-18.

In sum, we have achieved what we set out to do in 2006, and more. The accreditation process has led us to an understanding of the college that would have been hard to predict five years ago, and to fruitful insights about who we are, what we do, and how to continue to improve as we go forward.