

Course Cap Report by a joint subcommittee of CEPP, CC and DOF.

Contents

1. Background and Goals. Pp 1-2.
2. Methodology. Pp 2.
3. Within- and among-year variation: 2006 – 2011. Pp 2-3.
4. Summary of average course caps at 100-, 200-, and 300-level, by Dept and Program. Pp 3-7
5. Summary of average enrollments at 100-, 200-, and 300-level, by Dept and Program. Pp 7-10
6. Disambiguating average class size and average enrollment. Pp 11-15
7. Recommendations. Pp 15-19
8. Literature Cited. Pp 20-21.

1. Background and Goals.

In spring 2012, the Committee for Educational Planning and Policy (CEPP) and Curriculum Committee (CC) created a joint sub-committee to explore the consequences of a 2009 policy to alter the enrollment constraints on courses. The change in policy arose from CC's concern about departments asking for waivers and exceptions from the 2000 course cap guidelines and CEPP's concerns about maintaining excellent academic programs in light of budgetary shortfalls that were expected to continue into 2015. The recommendations from a 2009 joint subcommittee between CEPP, CC and the DOF were enacted with the intent of supporting three priorities: 1) minimizing inequities in students' academic experience; 2) minimizing inequities among disciplines, departments and instructors; 3) increasing institutional flexibility in our usage of human resources and facilities. The policy proposed that the maximum enrollment in 100-level courses be raised from a bounded range of 32-38 students to 35-38 students, 200-level courses be raised from 27-33 to 29-33, and 300-level courses be raised from 18-23 to 19-23. Each case represents an increase in maximum cap and a compression in the range of possible caps, with the latter being deemed particularly meaningful as a means to foster greater equity. The policy was implemented based on precedent from an earlier CEPP-CC subcommittee. Specifically, the 2000 CEPP-CC Committee charged with setting enrollment caps post reconfiguration concluded that their proposal "does not have to be voted on by the faculty because it is administrative policy. To the extent that it is educational policy, the committee believes it falls within the limits of decisions delegated to CEPP and Curriculum committee" (Minutes March 22, 2000 Meeting). The 2009 subcommittee followed that precedent, and communicated recommendations to the Faculty via the Department Chairs and Program Directors meeting in September 2009. Most of the policy changes for 100-, 200- and 300-level courses described above were implemented in 2010, although caps for some courses changed earlier (e.g., Scribner seminars changed in fall 2009) and many courses were exempted from the proposed changes in cap (in a fashion consistent with the recommendations of the 2009 subcommittee).

The 2009 report recommended that course cap policy be revisited in three years time. To that end, the 2012-2013 CEPP-CC-DOF subcommittee was charged with 1) assessing whether and how the magnitude of inequities in students' academic experience, and the inequities among disciplines, departments and instructors, differs between the period preceding the change in enrollment caps (e.g., fall 2006 - spring 2010) and the period following the change in caps and 2) interrogating whether and how institutional flexibility in our usage of human resources and facilities has been altered over that intervening period as a result of the new policy. The sub-committee was asked to consult current scholarship and colleagues with various

perspectives on the course enrollment policy and to communicate policy recommendations to CC and CEPP, who in turn will convey any recommendations they deem appropriate to the Department Chairs and Program Directors.

The members of the 2012-2013 subcommittee were Hugh Foley (at-large faculty, from Psychology), Robert Jones (at-large faculty, from Economics), Eric Morser (History, representing CC in spring 2012), Josh Ness (Biology and Environmental Studies, representing CEPP), Shirley Smith (Foreign Languages, representing CC in 2012-2013), Patti Rubio (Associate Dean, representing the office of the Dean of the Faculty in spring 2012) and Beau Breslin (DOF/VPAA, in fall 2012-spring 2013). The subcommittee was chaired by Josh Ness and the following report was written by the spring 2013 incarnation of the joint sub-committee (Profs Foley, Jones, Ness and Smith and DOF/VPAA Breslin).

2. Methodology.

We analyzed enrollment patterns and reported caps for courses from academic year 2006-2007 through 2010-2011. Enrollment and cap information were provided by the Office of Institutional Research. Changes in cap policy were implemented for some courses in fall 2009 and can be considered to be in “full implementation” in 2010-2011. The preceding years demonstrate pre-existing conditions as well as the inherent among-year variation in enrollment and caps. In describing the characteristics of the Social Sciences, Visual and Performing Arts, Natural Sciences, and Humanities, we include departments and programs in those divisions based on DOF Poston’s list.

Defining the boundaries for what we identify as “a course” was surprisingly challenging. Should 1-credit courses, internships, and independent studies count in the same manner as do more conventional 3 and 4 credit courses? How should we describe enrollment in an academic experience that combines a twice- (or thrice-) weekly common lecture with an associated lab or discussion section that meets once per week? Imagine such a course with 64 students in lecture and four affiliated 2-3 hr lab sections with 16 students each. Does a student experience this as a class of 64, as a class of 16, or something intermediate? Should the fact that lecture counts for three credits and lab one credit matter in this calculation? Does it matter whether such a course is coded as having a cap of 16 students (with concurrent modular sections that can be added *ad infinitum*) or 99? That distinction is certainly meaningful as it relates to course cap policy (an unbounded course has no cap!), and it also may have bearing on inter-course equity as experienced by students and faculty.

In the analyses described in Sections 3,4 and 5 below, we exclude Scribner Seminars, independent study-type courses (senior theses, internships, etc.), and courses worth 2 or fewer credits. For courses that include affiliated sub-sections (e.g., labs) that have caps we described the cap for the overall course as the product of the number of sections and the enrollment cap on each section. For example, a class with 10 labs sections each capped at 16 would be treated as having a cumulative cap of 160—the number of students that would sit in the common lecture if the lab sections were filled. We focus on mean responses for these courses, and note that an analysis of medians produced similar results.

Section 6 uses the same criteria for Divisions and experiences worth 2 or fewer credits.. It differs from Sections 3,4 and 5 in focusing on cumulative enrollments rather than on mean responses for the courses. Section 6 also includes an analysis of Scribner seminars.

3. Within- and among-year variation: 2006 – 2011

Figure 1 (below) illustrates patterns in enrollment at the College, and we hope to draw attention to several points. First, mean course caps are much higher than mean enrollment at the 100, 200 and 300-level (compare Fig 1A and 1B, noting change in y-axis). Second, the

maximum enrollment specified by the policy guidelines is much higher than the observed caps. In 100-level courses, the guideline was 32-38 students until spring 2010 and 35-38 after spring 2010, and neither are close to the observed range in Fig 1A. This generalization is also applicable for the 200-level courses (was 27-33 students, is 29-33 students) and 300-level courses (was 18-23, is 19-23 students). Third, there may be a slight trend toward higher mean caps in 2010-2011 for the 100- and 200-level courses. However, there are comparable fluctuations in earlier years and among semesters. Fourth, the number of courses offered by the divisions differs substantially and consistently over time (Fig 1D). That difference has obvious links to student choice, course caps, and the enrollment pressure manifested at the intersection of course caps and student preference.

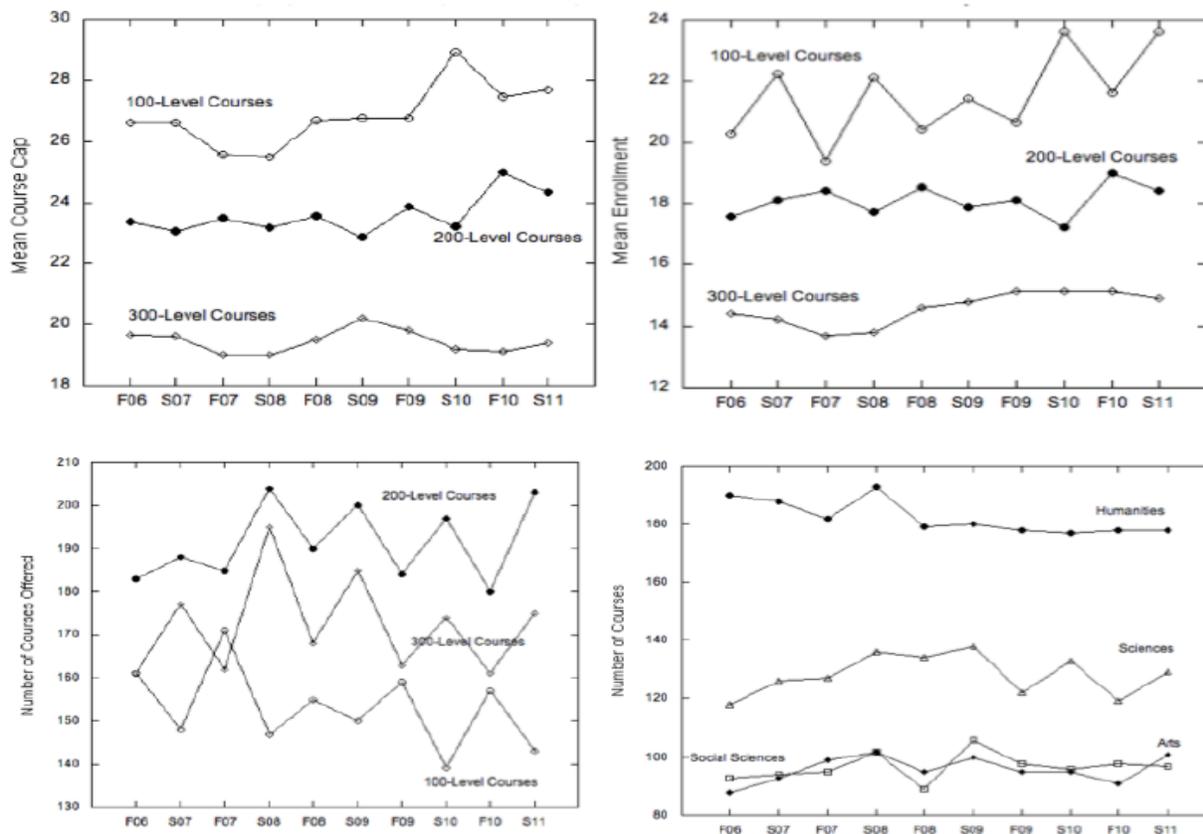


Fig 1. Enrollment and Policy. A) Fluctuations in mean course caps for 100-, 200, and 300-level courses, B) Mean enrollment 100-, 200, and 300-level courses, C) The number of course offered at each level, and D) The number of courses offered in each of the four Divisions of the College over the five-year span. Changes in course cap policy occurred in spring 2010.

In 06-07, 07-08 and 08-09, the average number of courses offered by the College (excluding internships, independent studies, etc., as well as Scribner seminars) was 1043 (SD = 23). The College offered 1016 courses in 09-10 and 1019 courses in 10-11; this represents ~2.% fewer courses than the three previous years. In 06-09, the average number of unoccupied seats was 5200 (SD = 32). The number of unoccupied seats was 5177 in 09-10 and 4931 in 2010-11.

4. Course caps.

Here, we present the mean caps for individual departments and programs in 2006-2010 and 2010-2011. Departments are color-coded by division: **Life and Physical Sciences in red**, **Social Sciences in blue**, **Humanities in green**, **Arts in brown**, **ID in black**. Some departments

have mean caps well above 33 (the maximum cap identified by both past and current policy). This typically indicates the presence of courses that have multiple subordinate sections that meet together for a common lecture multiple times per week. In these instances, cap is calculated as the product of the number of sub-sections and the enrollment cap on those subsections. For example, two sub-sections of 36 would be reported as an aggregate course with a cap of 72.

Based on comparisons of individual departments in their 2006-2010 and 2010-2011 incarnations (shown below), we conclude that compliance with course cap policy is inconsistent among departments across the College and shows only modest evidence of change after the new cap policy. There was no significant change in cap at the 100- or 300-level and some evidence of change at the 200 level. Further, the caps in many courses on campus are well below both the pre- and post-2010 guidelines. Such low mean course caps indicate that most courses are “exceptional”—an argument has been successfully made that the College’s guidelines should not apply to the particular course.

As seen in the tables below, many departments (especially in the humanities) offer 100-level courses capped (on average) between 20 and 30 students, 200-level courses capped between 20 and 25 students, and 300-level courses capped between 11 and 20 students. Given the proposed guidelines, these mean course caps indicate that many departments are not adhering to the guidelines, especially at the 100 and 200 level. Moreover, the discrepancies among departments (comparing left tables with right tables) are such that both student and faculty experiences are likely to differ substantially, depending on department.

100-Level Courses

According to the guidelines, the lower cap limit should be 35—a target met by fourteen departments. Thus, we use 30 (in 2010-2011) as the cutoff for the purpose of organization.

Dept	06-10	10-11	Change
GE	62.7	72.0	+9.3
BI	67.6	67.2	-0.4
EX	51.3	53.8	+2.0
ES	27.5	40.8	+13.3
DA	40.0	40.0	0
DM	37.8	36.0	-1.8
SO	32.0	35.0	+3.0
PS	44.1	35.0	-9.1
PH	33.1	35.0	+1.9
GO	35.0	35.0	0
RE	34.3	35.0	+0.7
DB	36.6	35.0	-1.6
WS	30.0	35.0	+5.0
HI	35.1	35.0	-0.1
AN	32.7	34.5	+1.8
NS	27.0	32.7	+5.7
MU	27.0	30.8	+3.8
CH	33.8	30.2	-3.6
EC	26.5	30.0	+3.5

Dept	06-10	10-11	Change
MA	28.1	28.5	+0.4
MB	25.7	26.1	+0.4
ED	25.0	25.0	0
AH	52.5	25.0	-27.5
AM	25.7	24.5	-1.2
PY	23.1	24.0	+0.9
AR	22.9	23.0	+0.1
TH	18.2	20.6	+2.4
CS	20.4	20.3	-0.1
FJ	20.9	20.0	-0.9
FI	21.0	20.0	-1.0
CG	20.0	20.0	0
FC	20.0	20.0	0
FS	19.4	20.0	+0.6
FF	21.0	20.0	-1.0
FG	20.8	20.0	-0.8
EN	15.5	16.1	+0.6
CL	23.3	NA	

There was not a significant increase in overall cap size at the 100-level as a result of implementation of the 2009 policy ($M_{06-10} = 30.9$, $M_{10-11} = 31.1$; paired t-test by dept, $t = 0.22$, $df = 32$, $p = 0.83$). With rare exceptions, the differences between the two periods are minor, in spite of a presumed increase in course caps. Eighteen out of 36 departments showed an increase in cap size (though modest in many cases—seven had increases less than one seat), which is not consistent with a general increase in course caps. Fourteen departments offered 100-level courses with mean course caps of 35 or greater (i.e., complied with the directive without exception). Some departments show virtually no increase in the 2010-2011 academic year and were allowed to offer 100-level courses with low course caps. Divisional differences (Life and Physical Sciences in red, Social Sciences in blue, Humanities in green, Arts in brown, ID in black) are also apparent.

200-level courses

According to the guidelines, the lower limit should be 29—a target met by only nine departments. Thus, we use 25 as the cutoff for 200-level course caps (for 2010-2011).

Departments with mean caps ≥ 25			
Dept	06-10	10-11	Change
CH	44.3	49.3	+5.0
DM	29.5	30.0	+0.5
DB	28.3	30.0	+1.7
WS	27.9	29.8	+1.9
PH	26.7	29.0	+2.3
GO	26.8	29.0	+2.2
RE	27.0	29.0	+2.0
MB	25.2	29.0	+3.8
AH	26.8	29.0	+2.2
HI	30.0	28.2	-1.8
PS	25.2	28.0	+2.8
FL	23.5	28.0	+4.5
CC	31.4	27.6	-3.8
SW	26.1	27.5	+1.4
ED	24.6	27.4	+2.8
AN	25.6	27.3	+1.7
NS	27.0	27.0	0
CG	20.0	27.0	+7.0
CL	20.0	27.0	+7.0
AM	25.7	26.8	+1.1
BI	23.5	25.6	+2.1
EC	25.7	25.0	-0.7
EN	23.1	25.0	+1.9

Departments with mean caps < 25			
Dept	06-10	10-11	Change
SO	23.6	24.0	+0.4
DA	22.0	23.2	+1.2
FS	20.9	22.7	+1.6
FF	21.3	22.7	+1.4
MA	21.0	22.4	+1.4
TH	18.4	20.6	+2.2
ES	22.3	20.5	-1.8
CS	20.3	20.5	+0.2
EX	17.7	20.0	+2.3
FJ	19.1	20.0	+0.9
FI	19.3	20.0	+0.7
FC	20.0	20.0	0
FG	21.5	20.0	-1.5
MU	19.0	19.7	+0.7
PY	16.3	17.5	+1.2
GE	16.5	17.0	+1.5
AR	17.2	16.8	-0.4

The discrepancies between departments are less pronounced among the 200-level course caps. There was also greater tendency for the cap to increase in 10-11, with 32 of 40 departments showing increases (paired t-test by dept, $t = 4.2$, $df = 38$, $p = 0.002$) though quite small (a fraction of a seat!) in some cases. Nonetheless, it's clear that some departments have relatively lower caps at *both* the 100 and 200 level.

300-level courses

The proposed guideline for 300-level courses is roughly 20, which we used for this table (2010-2011 data). There was no significant change in cap over time ($M_{06-10} = 19.3$, $M_{10-11} = 19.5$; paired t-test by dept, $t = 0.31$, $df = 37$, $p = 0.75$). As was true for the 200-level courses, the department caps appear to be less variable than for 100-level courses. Nonetheless, an inspection of all three tables reveals that there are departments that seem able to consistently set their caps lower than other departments.

Dept	06-10	10-11	Change
FL	27.5	40.0	+12.5
FI	21.8	25.0	+3.2
MB	24.9	24.6	-0.3
FS	24.0	23.8	-0.2
ED	21.8	22.9	+1.1
FF	22.7	22.7	0
DM	22.9	22.1	-0.8
CH	19.4	21.8	+2.4
CS	20.0	21.2	+1.2
DB	22.1	20.0	-2.1
PH	17.3	20.0	+2.7
GO	21.7	20.0	-1.7
RE	19.4	20.0	+0.6
CC	20.0	20.0	0
CG	20.0	20.0	0
CL	20.0	20.0	0
MA	20.0	20.0	0
EX	19.1	20.0	+0.9

Dept	06-10	10-11	Change
HI	19.4	19.2	-0.2
ES	18.2	19.2	+1.0
FJ	20.0	19.0	-1.0
EN	17.8	18.8	+1.0
PS	18.7	18.6	-0.1
AM	18.0	18.0	0
MU	17.7	18.0	+0.3
SO	16.8	17.8	+1.0
EC	16.2	17.5	+1.3
FC	18.1	17.5	-0.6
SW	18.2	17.2	-1.0
AH	17.1	17.0	-0.1
AN	17.7	16.7	-1.0
GE	16.4	16.0	-0.4
BI	17.6	15.9	-1.7
AR	15.6	15.8	+0.2
FG	17.7	15.0	-2.7
TH	22.5	14.5	-8.0
DA	15.5	12.5	-3.0
PY	10.2	11.0	+0.8

5. Enrollment.

Predicting how changes in course caps might affect enrollments in particular courses is challenging. If existing supply meets existing demand (i.e., the course does not typically fill) and all else is equal, increases in the cap for any course should not affect enrollment. In courses with full enrollments, where demand exceeds supply (due to topic, curricular requirements, an attractive timeslot, etc.), an increase in existing course caps should increase enrollments in the focal courses and perhaps modestly decrease enrollment in other courses or sections. However, the identity of these peer courses is difficult to identify—other sections of the same course, courses in the same department with similar pre-requisites, and courses in the same discipline with similar pre-requisites are all candidates to experience indirect effects of a change in cap to a particular course. This ambiguity makes it difficult to predict and describe the policy’s consequences. Nonetheless, the data below provide a sense of the overall impact of the change in course caps.

The enrollment data, parsed by Department or Program for 100-, 200- and 300-level courses, illustrate the impact of “increased” course caps on enrollments. The bottom line is that the impact was typically modest. Moreover, and consistent with the course cap data, there are substantial differences across departments (especially for 100-level courses). For the most part,

these differences predated any change in course cap—so they represent ongoing discrepancies in the class size that students and faculty experience.

100-level courses

Although 19 departments had mean course caps set at 30 or more, only 9 departments had mean enrollments greater than 30 in 10-11. Moreover, enrollments less than 20 (which might ordinarily typify small seminars in some departments) are the norm for 100-level courses in some departments.

Twenty seven of 37 departments showing some increase in the 2010-2011 academic year. Although there was a modest increase in overall mean enrollment ($M_{06-10} = 25.5$, $M_{10-11} = 26.5$), it was not statistically significant.

Depts with mean enrollments ≥ 30			
Dept	06-10	10-11	Change
GE	56.8	68.0	+11.2
BI	58.3	63.2	+4.9
EX	43.1	44.3	+1.2
ES	23.9	37.8	+13.9
DA	32.5	37.3	+4.8
AN	30.6	34.3	+3.7
PS	38.7	33.1	-5.6
SO	29.9	32.3	+2.4
DM	33.3	31.5	-1.8

Depts with mean enrollments < 30			
Dept	06-10	10-11	Change
NS	21.9	29.3	+7.4
HI	23.1	28.3	+5.2
PY	22.4	28.0	+5.6
CH	29.9	27.3	-2.6
MU	22.5	26.8	+4.3
SW	23.2	26.7	+3.5
EC	22.9	25.3	+2.4
AH	53.0	24.7	-28.3
MA	19.9	24.3	+4.4
ED	18.6	22.8	+4.2
AM	17.8	22.3	+4.5
MB	23.8	22.0	-1.8
GO	27.6	22.0	-5.6
WS	18.4	21.7	+3.3
DB	32.9	21.5	-11.4
FF	16.5	21.0	+4.5
RE	25.6	20.8	-4.8
PH	20.8	20.0	-0.8
TH	17.5	18.7	+1.2
AR	18.9	17.8	-1.1
FC	15.8	17.3	+1.5
CS	15.1	17.0	+1.9
FS	15.7	16.8	+1.1
FI	14.1	16.6	+2.5
FJ	16.2	16.3	+0.1
EN	14.5	15.4	+0.9
FG	12.6	14.7	+2.1
CG	12.0	14.0	+2.0
CC	13.0	NA	
CL	12.2	NA	

200-level courses

Because only four departments had mean enrollments of 25 or greater (the value used earlier for course caps), we use a cutoff of 21. Thirteen departments had such enrollments, but the far greater number of departments had much lower mean enrollments.

Depts with mean enrollments ≥ 21			
Dept	06-10	10-11	Change
CH	36.7	43	+6.3
SW	23.2	26.7	+3.5
AH	23.2	26.0	+2.8
DM	21.3	25	+3.7
DB	21.9	24.5	+2.6
MB	23.4	24.1	+0.7
BI	18.9	23.8	+4.9
PS	22.0	23.5	+1.5
AM	21.3	22.4	+1.1
EC	22.6	22.2	-0.4
AN	21.3	22.0	+0.7
NS	NA	22	
SO	19.8	21.3	+1.5

Depts with mean enrollments < 21			
Dept	06-10	10-11	Change
HI	22.0	20.9	-1.1
RE	20.3	20.8	+0.5
DA	17.4	20	+2.6
EN	18.1	19.9	+1.8
ED	15.3	19.8	+4.5
MA	16.1	19.4	+3.3
PH	20.9	19.3	-1.6
CC	19.0	18.0	-1.0
ES	18.8	17.8	-1.0
GO	20.5	17.6	-2.9
FS	15.7	15.8	+0.1
FL	15.0	15.8	+0.8
EX	14.9	15.7	+0.8
FI	12.5	15.0	+2.5
FJ	8.8	15.0	+6.2
AR	13.6	14.2	+0.6
MU	15.1	14.1	-1.0
PY	12.8	14	+1.2
WS	13.5	13.5	0
GE	11.3	12.5	+1.2
FF	13.5	12.4	-1.1
TH	12.5	12.2	-0.3
FC	7.9	10.7	+2.8
CS	9.1	6.5	-2.6
FG	7.1	6.5	-0.6
CL	10.3	6.0	-4.3
CG	5.3	5.0	-0.3

300-level courses

For 300-level courses, enrollments were a bit discrepant (with the notable high enrollment in 10-11 for FL). Eight departments, for example, consistently have mean enrollments of 10 or fewer students! Nonetheless, 25 departments show some increase in enrollment for the 2010-2011 academic year.

Depts with mean enrollments ≥ 15

Dept	06-10	10-11	Change
FL	22.3	39.0	+16.7
CH	16.8	18.8	+2.0
PS	17.3	18.7	+1.4
MB	20.7	18.5	-2.2
EN	15.0	17.4	+2.4
ES	16.6	17.4	+0.8
BI	11.9	16.8	+4.9
AM	13.7	16.4	+2.7
EC	14.4	16.4	+2.0
SO	13.6	16.0	+1.4
FF	13.9	16.0	+2.1
DM	16.0	15.8	-0.2
FS	14.5	15.8	+1.3
GO	18.1	15.6	-2.5
DB	15.2	15.3	+0.1
HI	14.5	15.1	+0.6
EX	13.8	15.0	+1.2

Depts with mean enrollments < 15

Dept	06-10	10-11	Change
RE	10.7	14.5	+3.8
AN	14.4	14.2	-0.2
AH	12.0	13.9	+1.9
MA	11.3	13.3	+2.0
AR	12.5	12.6	+0.1
CS	9.4	12.6	+3.2
SW	12.2	12.5	+0.3
CC	12.0	12.0	0
MU	13.4	11.9	-1.5
ED	13.1	11.3	-1.8
PH	11.2	10.7	-0.5
TH	14.7	10.6	-4.1
FI	11.8	10.5	-1.3
DA	7.6	10.0	+2.4
CL	8.3	8.5	+0.2
PY	5.9	8.0	+2.1
GE	8.9	7.7	-1.2
FC	5.6	6.5	+0.9
CG	4.8	5.5	+0.7
FJ	5.1	3.5	-1.6
FG	3.5	3.0	-0.5

6. Disambiguating average class size and average enrollment.

Many students and instructors can articulate how courses of 10, 20, 30, 60 and 100 students differ from one another in the interaction between the student and instructor (Smith and Glass 1980; Moore *et al.* 1996; Angrist and Lavy 1999). This gestalt is part of what brochures for prospective students allude to when highlighting attractive student to faculty ratios. For example, the *US News* profile of Skidmore advertises a student-faculty ratio of 9:1 and “68.9% of classes with fewer than 20 students” (see <http://colleges.usnews.rankingsandreviews.com/best-colleges/skidmore-college-2814>). The College’s site advertises an average class size of 17 (<http://www.skidmore.edu/about/>). We expect that prospective students and their parents interpret these statements from the perspective of a student, imagining “I (she/he) will be classes with 15-20 students” and “One class in three (or four) will have more 20 students.”

Here, we describe the fraction of student enrollments in courses with different numbers of students. For the purpose of this analysis, we treat each enrollment in a course as a “Skidmore-provided learning experience”, and the total number of enrollments in all the courses constitute the sum total of all the “experiences”. We treated courses that have multiple sections that meet in one common time and place as an integrated course (irrespective of whether they had an accompanying discussion section that divided the course into smaller modules or a formal 1-credit lab with smaller numbers of students). This logic is consistent with earlier analyses, in that a 1-credit lab experience does not qualify as an independent “course”.

We illustrate the proportions of enrollments occurring in particular settings using curves.

In these figures, the x-axis (horizontal) describes class size, and the curves illustrate the proportion of *all enrollments* that are in courses at or smaller than the size indicated on the x (horizontal) axis. In the example curve shown in Figure 2, no enrollments occurred in courses with fewer than 7 students (i.e., there were no such courses), 20% (0.2 on the y-axis) of the enrollments were in courses with 15 students or fewer, 90% of the enrollments occurred in courses with 30 students or fewer, and 100% of enrollments occurred in courses with 40 students or fewer (i.e., there are no courses with >40 students). In essence, if you surveyed 100 randomly selected students and asked them whether their courses was equal to or smaller than X (example: “20 students”, as asserted by *US News*), the value on the y-axis (vertical) would give you the proportion of students answering in the affirmative. In this hypothetical example, ~70 of the 100 students (0.7) would report that their experience occurred in a class with 20 or fewer students. It could also be understood as a visualization of the range of descriptions that parents might hear when inquiring about their student’s experience in randomly selected courses. Twenty percent of the parents would hear about a course with 15 or fewer students, and 90% would hear about courses with no more than 30 students. The median enrollment (e.g., the class size wherein half the students are taking a course equal to or smaller than this size and half the students are taking a course with more students) might be a useful benchmark. We can also use the differences between two values to calculate the proportion of students in different settings. For example, in Figure 2, 20% of the enrollments were in courses with 15 students or fewer and 90% of the enrollments occurred in courses with 30 students or fewer. Hence, we can conclude that 70% (= 90%-20%) of the experiences occurred in courses with enrollments between 16 and

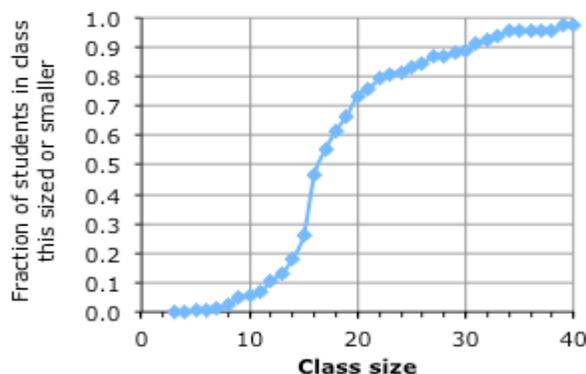


Figure 2. Example enrollment curve. Gridlines can be used to link the fraction of enrollments that occur in courses at or below threshold sizes (y and x axis, respectively).

30 students. For the purposes of visualization, lines that sharply ascend from zero to 1 (0 to 1.0) within a limited range of the possible courses sizes indicate that all the courses have similar numbers of students enrolled (low among-course inequity in enrollments), and the location of that ascension point on the x-axis indicates the size of courses in question.

Scribner seminars (Figure 3) offer a nice example for visualizing a coordinated, effective enrollment policy. None of the 229 Scribner seminars offered between fall 2006 and fall 2010 had fewer than 8 students enrolled and none had more than 18 (or more than 15 prior to 2009, and the one course with 18 in 2010 was abnormal). The mean number of students per seminar was 13.6 in 2006-2008 and 15.6 in 2009-2010. In 2006-2008, 29% of the students are in seminars with 13 or fewer students, and sharp ascent between 13 and 14 (from 29% to 73%) reveals that many of the students (44%, or 73-29) were in a seminar of 14 students. The rightward displacement of the red line from the blue in Figure 3 indicates an increasing fraction of the first-year students enrolled in larger Scribner seminars – a result partly attributable to the increase in course cap in fall 2009. Note that we don't see a pronounced change in inter-seminar equity. In 2006-2008, first year students in different seminars would report enrollments that were similar to one another (~60% in classes with 13 or 14 students); students in 2008-2010 would also discover similar class sizes to one another, here, ~71% are in classes with 15 or 16 students. Equity in faculty work associated with the Scribner seminars within a year may follow a similar pattern (that is, faculty in 2006-2008 were often mentoring comparable numbers of students in each course, as were faculty in 2009-2010, even though they were all mentoring more students).

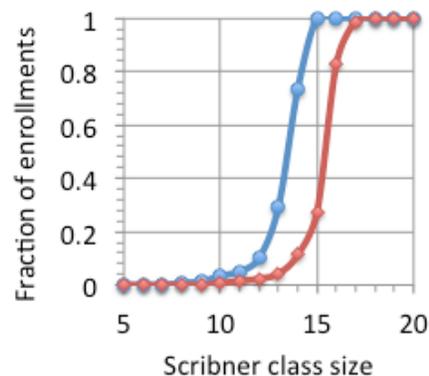


Fig 3. Visualization of enrollment for Scribner seminars in 2006-2008 and 2009-2011 (blue and red lines, respectively).

An analysis that focuses on enrollment patterns rather than mean class size is powerful for several reasons. It helps us quantify enrollment in a fashion that captures how *students* experience courses. It also helps us see how even a small number of courses with large enrollments can change the lived experience for many (and perhaps most) students. For the purpose of illustration, when a College supports 9 instructors who teach courses with 10 students and 1 instructor who teaches a course with 100 students, a majority of the aggregate student experience occurs in the setting with 100 students [i.e., $(9*10) < (1*100)$]. Two consequences are that 1) the hypothetical College can accurately report that 90% of the courses are limited to 10 students, even as 2) most students do not experience those small courses and/or, if asked to describe their class, would not report that sort of intimate experience. That dissonance may be subtle – in this example, the near-unanimous impression of the faculty that they collectively teach small, intimate courses is accurate!

To be clear, much of the variation that will become apparent in the enrollment patterns explored in the forthcoming analysis was not intended to be “solved” by the cap policy enacted in 2009-2010. For example, courses with large shared lectures have special exemptions for enrollment or require that students formally enroll in modular sub-sections that function as labsections and may be capped at low levels (e.g., 16 students in many life science courses). Writing-intensive courses have protected enrollments (relatively small class sizes). We present the analyses here in the hope that it will help the reader to more accurately understand the enrollment patterns experienced by students. It is important to note that these patterns can diverge from faculty experience, especially in comparing faculty across different disciplines.

Changes in enrollment between 2006-2009 and 2010-2011

Median enrollments (i.e., the class size where half the total enrollments occurred in smaller courses and half the total enrollments occurred in larger courses) differ with discipline and over time (Fig 4). Median enrollments in 100-level courses in 2009-2011 increased by one student relative to 100 level courses in 2006-2009, and this change was consistent across all four divisions. However, the baseline size of the course experienced as a result of the median enrollment in a 100-level course differs greatly with division. Half the students enrolled in 100-level Humanities courses are in a class with 16 or fewer students (including themselves), whereas half the enrollments in 100-level Social Science and Natural Science courses place the student in courses with more than 27 or 35 students, respectively (Fig 4).

Although changes in the median or average enrollments over time need not alter the magnitude of inter-course disparities in enrollment, that pattern did occur in some disciplines. In the Humanities, the inter-course disparities in enrollment in 100-level courses *decreased* after 2009 (Fig 4a). The opposite pattern occurred in the Natural sciences; inter-course disparities in enrollment in 100-level courses increased after 2009 (Fig 4a). Enrollment curves for the Social Sciences were essentially consistent between 2006-09 and 2009-11 (Fig 4b). Enrollment curves for the Visual and Performing Arts were relatively consistent between 2006-09 and 2009-11 (Fig 4b), although the proportion of enrollments that occurred in courses with ≥ 25 students increased from $\sim 8\%$ to $\sim 18\%$.

We don't need to exclusively focus on the *median* student enrollment. For a variety of reasons, some courses may have atypically low enrollments or atypically high enrollments (i.e., "high" in the sense of large shared lectures). For the purpose of focusing on the typical student experiences, we could ignore the 10% of enrollments that occur in the smallest courses and the 10% of enrollments that occur in the largest courses, and ask whether the remaining 80% of the student experiences differ within the curriculum or over time. In the Natural Sciences, the intermediate class sizes experienced by the middle 80% ranged from 17 to 100 students in 2006-2009 and 21 to 116 in 2010-2011 (increase in size of small "typical" classes and in size of high typical classes; Fig 4a). In Visual and Performing Arts, the range of shared lecture sizes was 12.5 to 23.5 in 2006-2009 and 12.5 to 39.5 in 2009-2011 (no change on low end, creep on the high end; Fig 4b). In the Social Sciences, the range of shared lecture sizes was 18.5 to 33.5 in 2006-2009 and 18.5 to 34.5 in 2009-2011 (essentially no change over time; Fig 4b). In the Humanities, the range of shared lecture sizes was 11.5 to 32.5 in 2006-2009 and 11.5 to 30.5 in 2009-2011 (decrease in size of large classes; Fig 4a).

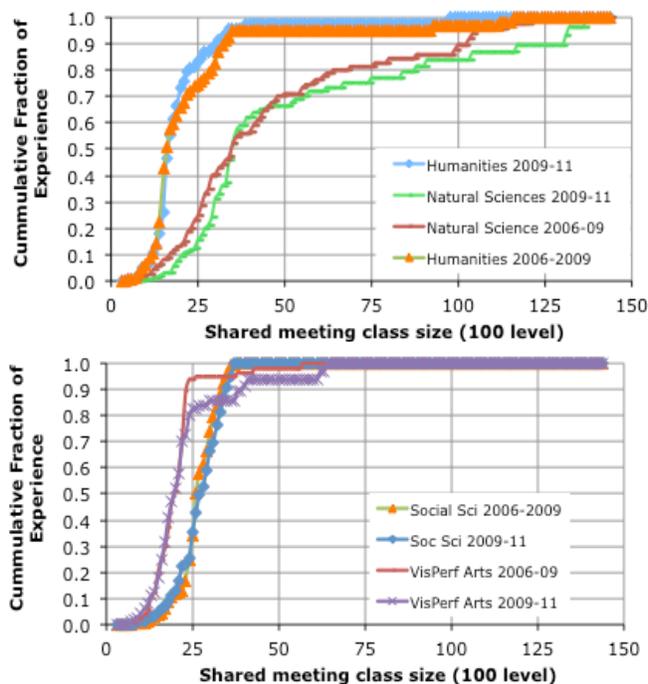


Fig 4. Experienced class size curves for students in the 100-level courses. Curves are shown for 2006-2009 and 2010-2011. For the sake of clarity, Humanities and Natural Sciences are shown in Fig 4A (top), and Social Sciences and Visual and Performing Arts in Fig 4B (bottom).

What is the significance of the idiosyncratic curves for each division, and changes in those four curves over time? One effect was that disparities in the class sizes experienced by students in 100-level Humanities and Sciences courses were more pronounced in 2010-11 than they were 2006-2009. The evidence of this increase in disparity is that the area between the curves for Humanities and Nat Sciences in 2006-2009 is less than that in 2009-2011 (see Fig 4a). Further, this increasing disparity is the result of two factors – enrollments in Humanities courses became more similar to one another since 2009 (fewer very small or very large courses) even as enrollments in Natural Science courses became more divergent from one another since 2009 (i.e., the natural sciences is increasingly experienced by students at the 100-level in the context of a Davis/Emerson/Gannett -style lecture hall). Relatively speaking, Humanities courses are a model for equitable distribution of interactions between faculty and students. The Humanities faculty teaches courses that are similar in sizes and relatively small, and they’ve managed to maintain these characteristics even as they enroll many students (in aggregate) and as the median enrollment has modestly increased since 2009.

We also performed these same analyses for 200- and 300-level courses offered by the College in 2009-2011. Figure 5 shows the enrollment curves for 100-, 200- and 300-level courses in the four divisions (with the 100-level merely replicating some of the information already shown in Fig 4). The inter-division disparities in class sizes that are so evident at the 100-level courses become less pronounced at the 200-level, and disappear at the 300-level. Students can confidently expect 300-level courses of a certain bounded size, irrespective of the disciplinary home of the course. Further, there is a satisfying congruence between the size of these 300-level classes as experienced by the median enrollment (16-18) and the average class sizes that students might expect based on media such as the *US News* and the College’s own materials. Clearly, faculty and administrators seeking to minimize inter-divisional differences in enrollment patterns, and to better align student experience with expectations, should focus attention on the 100- and 200-level courses.

The equity and attractive class sizes evident in the 300-level courses is good news. However, bear in mind that 300-level courses have pre-requisites and build on previous experiences. This has implications for the College’s delivery of the “liberal arts experience” and the students’ engagement with the College’s breadth requirements. Imagine a first-year student

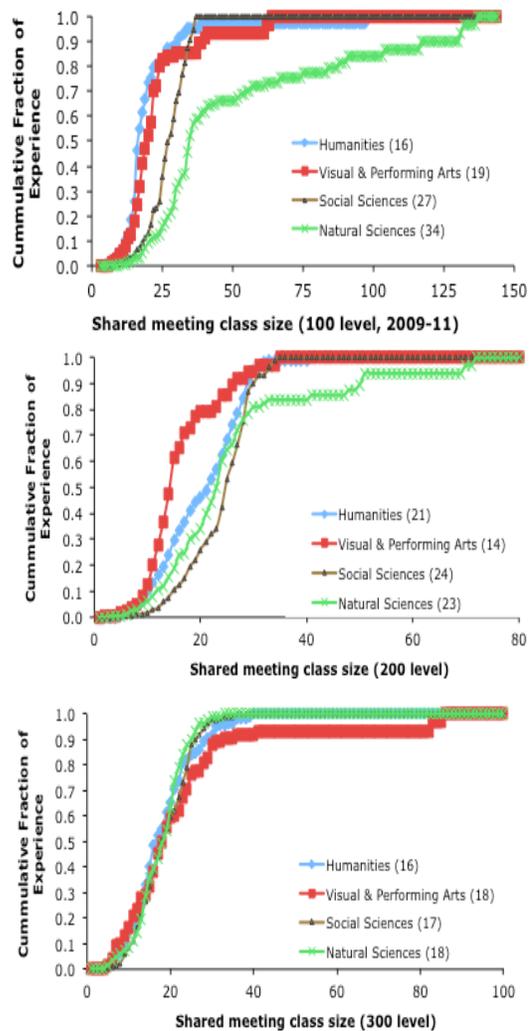


Fig 5. Distribution of experienced class sizes for students enrolled in the Humanities, Natural Sciences, Social Sciences and Visual and Performing Arts in 2009-2011. A) 100-level courses, B) 200-level, C) 300-level. Note inconsistencies in values on X axis (class size). The numbers in parentheses refer to the class size wherein the median enrollment occurred in Fall 2009-spring 2011; half the enrollments were in smaller courses and half were in larger.

who embraces the liberal arts philosophy - (s)he enrolls in a Scribner seminar and a course from each of the four divisions (a Humanities course, a Social Science course, a Visual and Performing Arts, and a Natural Sciences/Math/Computer Science course). If those courses are all from the 100-level, the student enrolls as the median enrollment (i.e., has the same likelihood of enrolling in a large 100-level courses as in a small one – something that is not true given the late enrollment by incoming students, but simplifies predictions), and the course sizes and enrollment patterns in 2009-2011 are still applicable, the student will enroll in a Scribner with 15 students and four other courses with 16, 19, 27, and 34 students (Humanities, Arts, Social Sciences and Natural Sciences, respectively; see Fig 5). The average class size experienced by this student is 22.2, and two classes have fewer than the 17 students the student (and parents) may expect. If we assume that the student enrolls in three additional courses drawn from the four divisions to complete the cumulative “first year experience” ($1+4+3 = 8$ courses in the first year), the average class size experienced by the student will range from a low of 19.9 (if they pivot to the Humanities and enroll in three Humanities courses after completing the Scribner plus one from each division) to a high of 26.6 (if they make a similar pivot, albeit to the Natural Sciences). Large class sizes may also be typical for students who are not science majors but are nonetheless required to enroll in a large number of courses in the STEM disciplines (e.g., pre-med and pre-vet students prepare for entrance exams with a year of introductory Biology, Chemistry, Physics and Mathematics; Porter Scholars must enroll in one STEM course each semester).

As courses and faculty hours are currently configured, a student who is not taking advanced (300-level) course in the Natural Sciences is unlikely to experience a course in the Natural Sciences with 15 or fewer students. Conversely, a Natural Science major may well experience a 100- or 200-level course with 15 or fewer students in the Humanities. That may be a meaningful distinction in how the student body engages the disciplines, and comes to appreciate their particular value. Furthermore, if students’ choice of major is informed by their experiences in lower-level courses, first- or second-year students may need to choose their major based on different sorts of information. For example, a student who has enrolled in multiple 100-level Humanities courses may have an accurate preconception of what Humanities courses at the 200- and 300-level may entail (at least insofar as the similarities in class size captures some of the pertinent dynamics). We draw this inference based on the similarity of the enrollment-by-class-size patterns evident for the Humanities in Fig 5A, B and C (100-, 200- and 300- level, respectively). In contrast, prospective majors in the Social and Natural Sciences may need to draw conclusions about those disciplines based on their experiences in a suite of classes with 30, 40, or even 140, other students. For some students, this may require an understanding that “things will be different” (to say nothing of perseverance).

Disambiguating average class size and average enrollment: Conclusion. As inter-course inequity in enrollments increases, the class size experienced by the faculty body increasingly diverges from the class sizes as experienced by student body. In many sectors of the College, the mean class size experienced by a student greatly exceeds the mean class size. Indeed, unless all classes are the same size, *it is inevitable that a description of the mean class size feeds a misconception that most classes experienced by a student are smaller than they are.* This difference is least pronounced in settings where class sizes are generally similar, as they are across the curriculum in the Humanities and at the 300-level across the Divisions.

7. Recommendations.

Our recommendations take into account two important, and intertwined, issues. The first is under the control of the college faculty and administrators—maximum course size (cap). The second is under the control of our students and is based on the choices they make—enrollments.

Recommendation 1. *Course caps should more closely resemble observed enrollments.*

The average 100-level class size (treating department and programs as replicates) was 19.6 in 2006-2010 and 20.8 in 2010 – 2011, and ranged from 10 to 37 in 2006 - 2010 and 10 to 35 in 2010 - 2011. The 2009 course caps are far out of the ranges of observed enrollments and, as a result, the increase in course cap may have negative effects on the variation in sizes of classes actually offered. For example, the imposition of unrealistically high enrollment caps results in inequitable differences in enrollments across different sections of the same course. If course caps are intended to engender equitable distribution of students across different sections of the same course, caps need to be set slightly (say 10%) above the average enrollments for that course. For example, if the average enrollment for a course is 23, a course cap of 25 per section would even out variations in student experiences for those taking that course without compromising the students' ability to enroll in the course. That decrease in variation would also engender more equitable utilization of classrooms and times. High caps increase the likelihood that a course section offered at a popular time (e.g., afternoon) will draw a disproportionate fraction of the students enrolled in the course as a whole. As a result, space may be underutilized (empty or used by fewer students than intended) at other times. Setting realistic caps on a course-by-course basis has the potential for creating a more equitable distribution of class sizes, faculty teaching loads and the distribution of class days and times across the whole week (including morning, evening and Friday classes).

Realistic course caps have worked effectively with the Scribner seminars (see Section 6) and 100-level English courses. The 100-level English courses had a mean cap of 15.5 and an average enrollment of 14.7 ± 2 (mean \pm SD) students per class in 2006-2010. Mean cap increased to 16.1 in 2010-2011, and average enrollment increased to 15.5 ± 1.5 . In each case, the cap is only modestly larger than the average class size, and an increase in that cap preserved, and in some cases even increases, the equity among class sizes (even as it also increased the average class size). One statistical measurement of equity is the coefficient of variation – the ratio of the standard deviation among the samples to the mean value of the samples. For 100-level English classes, the coefficient of variation decreased from 0.14 ($=2/14.7$) in 2006-2010 to 0.10 ($=1.5/15.5$) in 2010-2011; that is, inter-course variation in enrollments modestly decreased. Scribners can be described similarly. As Scribner caps modestly increased (see Section 6), mean enrollments per seminar increased from 14 ± 1.6 in 2006-2010 to 15.9 ± 0.8 in 2010-2011, and the coefficient of variation shrank from 0.11 to 0.05. Note that these coefficients are very low (i.e., equity is very high) relative to rest of the College. The CV for courses at the 100-level in other Humanities departments in 2010-2011 (a reasonable peer group for English) were 0.63 (Music), 0.54 (American Studies), 0.51 (History), 0.22 (Foreign Languages and Literatures), 0.21 (Art History), 0.19 (Philosophy), 0.15 (Religion) and 0.10 (Classics).

Recommendation 2. *An enrollment policy designed to engender greater equity would require that departments follow similar policies.*

The irregular implementation of caps and the “exceptional status” of many courses are a recipe for a Tragedy of the Commons. Improving that situation requires supporting departments that may have particular concerns regarding their vulnerability when acting on behalf of the “common good”. For example, our analysis identifies Anthropology, Environmental Studies, Psychology and Sociology as examples of academic units that both increased caps at the 100-level and experienced sufficient demand such that these changes in caps meaningfully influenced enrollments (see Section 4 and 5).

Cap implementation may also influence the distribution of instruction across time slots within the week. If only a few departments implemented course caps slightly above the average

course enrollments and offered early morning, evening and Friday classes (a trio deemed unattractive by a some students), students may be more likely to enroll in alternative courses on Monday through Thursday afternoons. Enrollments in some courses in the trio of aforementioned time slots would decrease, as would the perception of demand for the discipline. As a result, departments would then have an incentive to reduce their early morning, evening and Friday section offerings rather than lose students to departments that restricted course offerings to the popular afternoons.

Recommendation 3. *A policy that lowers course cap has the greatest potential to decrease inequities in enrollment, increase student-faculty engagement (insofar as this is a product of ratio of students to faculty in an academic setting) and increase space utilization (i.e., have classrooms routinely occupied by courses with the realized enrollments suitable to that space).*

Smaller class size has a positive impact on classroom participation, students' actual learning (as well as students' perception of their learning), and students' assessment of the quality of the course (Bandiera *et al.* 2009, Chapman and Ludlow 2010, De Paola and Scoppa 2009, Grudnitski and Krentler 2011, Rocca 2010). Thus, students and faculty at Skidmore who consistently experience small class sizes are at an advantage. Given the many "exceptions" in place for certain courses, it is unlikely that their course caps will increase. Moreover, it would be educationally disadvantageous to do so. Therefore, the path to greater equity in both student and faculty experiences across the college would be to decrease course caps.

There are other potential benefits. For example, forcing students who might otherwise occupy seats #28, 29, 30 and 31 in a 200-level discussion course to take the 17th, 18th, 19th, and 20th seats in an under-enrolled course (or section of that same course) might create some discomfort for students who are encouraged to believe that there are seats available in every course in the catalog in every semester. However, it would also 1) be more efficient, 2) possibly enhance the "popularity" of some under-enrolled courses by increasing the variety of students in them, 3) encourage students to explore courses that, based on the limited information provided in a course catalog and other media, do not currently attract sufficient interest to engender enrollment, 4) decrease the likelihood that such courses might be cancelled due to under-enrollment, and 5) assure that already popular courses do not become less so as a result of surging enrollments. If raising caps has the potential to increase among-course disparities, and, as a result, compromise the academic environment in the most and least popular classrooms, the converse may also be true. Hence, we recommend lowering the caps to levels below those that existed prior to the 2009 policy.

Prior to 2009-2010, caps were 32-38 for 100 level courses, 27-33 for 200-level courses, and 18-23 for 300 level courses. Based on the enrollment patterns in figure 1 (pp 3) and our recognition that course caps are most meaningful when they are near mean enrollments, we infer that these caps were too high to have the desired consequences. We recommend a course cap of 28 students for 100-level courses, a cap of 22 students for 200-level courses, and a cap of 18 students for 300-level courses. This recommendation lowers the maximum cap for 100-level courses by 10 (from 38 to 28), for 200-level courses by 11 (from 33 to 22), and 300-level courses by 5 (23 to 18). Further, it abolishes the range of course caps (e.g., "a 300-level course has a cap in a bounded range between 19-23").

Recommendation 4. *Review the justification for each course with enrollments that are far below the cap (e.g., 8) or that are substantially greater than the cap (e.g., 40). Inevitably, as seen in the enrollment data provided, some courses will attract a small number of students. Allowing such courses to go forward certainly has resource implications. As is currently the case, we encourage the Dean of Faculty to discuss each under-enrolled course with the Chair to determine if it is*

prudent to proceed with the course. Although published research largely ignores the issue of such small classes, we suggest that an enrollment of eight might trigger such a discussion.

At the other extreme, there are situations in which courses will proceed with enrollments greater than the proposed caps. We recognize that large lecture courses can be highly effective, particularly when combined with emerging pedagogies (e.g., team-based learning, i-clickers, flipping the classroom), additional support, and instructors that are well suited for, and experienced in, teaching in this setting. Further, the students' views of large courses as unfavorable sites for teacher-pupil interactions (Moore *et al.* 1996) can be uncoupled from their perceptions of overall course and/or instructor effectiveness (Marsh *et al.* 1979). For example, courses that utilize a combination of class sizes - pairing twice-weekly discussion groups with a large shared lecture once a week - can engender greater cognitive learning (i.e., knowledge transfer and retention) than do moderately larger self-contained courses on the same topic (twice-weekly discussion sections of 23 students and a large lecture of 345 students versus an incarnation of the course limited to thrice-weekly meetings of 26 students, Messman and Jones-Coreley 2001). However, in this case the large lecture was the exception (i.e., two-thirds of student time occurred in smaller discussion sections). To our knowledge, no comparable course exists at Skidmore. The large shared lecture always occurs more frequently than the lab/discussion section (two or three times a week versus once, respectively) and in only one course does the non-lecture component exceed the lecture in cumulative time commitment per week (Organic Chemistry with a four hour lab each week). Further, evidence for affective learning (i.e., change in attitude towards course topic) was greater in the self-contained course (Messman and Jones-Coreley 2001). There is also evidence that the manner in which instructors communicate with students affects these outcomes. Students that perceive their instructors as more immediate (reducing the psychological distance between instructor and student) experienced both greater cognitive and affective learning, and lack of immediacy is particularly detrimental to affective learning in courses with a large shared lecture (Messman and Jones-Coreley 2001). Student perceive greatest instructor immediacy in classes with fewer than 20 students, and immediacy in classes with over 40 students was statistically indistinguishable from immediacy reported for very large classes with >100 students (Moore *et al.* 1996).

When course ratings by college students show a significant relationship with class size, the relationship is most often negative (i.e., lower ratings as class size increases; reviewed by Feldman 1978, 1984). However, some studies demonstrate an intriguing curvilinear pattern, wherein intermediate sized classes are rated least favorable relative to both smaller and larger classes (Feldman 1978, 1984; also see Marsh *et al.* 1979, Centra and Creech 1976). This may occur because instructors and/or students have expectations for intermediate-sized courses that include elements typical of either small or large courses, and this discrepancy engenders confusion and/or dissatisfaction in their learners. Other challenges include that “small” and “large” are not consistently defined in an absolute sense within the literature as a whole. Individual studies can be useful here; in the Centra and Creech (1976) study demonstrating a curvilinear pattern, courses with fewer than 15 students received the highest ratings, classes with 35-100 students received the lowest ratings, and classes with 15-35 and >100 students received intermediate ratings. Another concern is that published comparisons of students' perceptions of those courses rarely account for other influential factors such as those described above—institutional support, electives versus requirements, etc.—and, most critically, instructor identity (Marsh 1982; Marsh and Bailey 1993). Perhaps the clearest evidence that class size can be meaningful comes from an analysis of pairs of courses taught by the same instructor that vary in enrollment. Where this analysis has been performed, the course with the smaller enrollment is routinely rated more highly by students, and this effect explains much more of the inter-course variation in evaluations than do other characteristics such as the elective/requirement dichotomy or course level (Bausell

and Bausell 1979). This difference in perception becomes even more pronounced when the compared courses focus on the same topic taught at the same level (i.e., same course number; Feldman 1978, Holland 1954). Hence, although a particular course with many students can be effective, evidence supports the generalization that it would be even more meaningful to students when offered in a more intimate setting, and that small 100- and 200-level courses are perceived as favorably as are 300-level courses that routinely involve small class sizes (Bausell and Bausell 1979). Critically, meta-analyses also demonstrate that smaller class sizes are associated with 1) favorable effects on both instructors (e.g., morale, attitudes towards students) and students (interest in school, sense of participation)(Smith and Glass 1980), 2) greater student achievement in a course (Glass and Smith 1979; Hedges and Stock 1983), and 3) some evidence of enhanced performance in subsequent courses (Wyss *et al.* 2007 and references therein).

What makes a threshold of 40 students in a class particularly well suited as a trigger for review? We can draw upon scholarship that demonstrates decreases in perceived instructor-student immediacy when classes exceed 40 students (Moore *et al.* 1996), lowest student evaluations of courses and instructors when a course includes 35-100 students (Centra and Creech 1976; Feldman 1978, 1984), and even Talmudic rule (“*The number of pupils assigned to each teacher is twenty five. If there are fifty, we appoint two teachers. If there are forty, we appoint an assistant.*”; see Angrist and Lavy 1999). More practically speaking, one rule of thumb might be that we endeavor to avoid classes that are so large that they require special explanation and/or disclosure during tours for prospective students (“all the classes are small and all my professors know my name, except in X, Y and Z”) or that some might perceive as being inconsistent with the implicit contract between a costly liberal arts college and its students. Courses with lectures more than twice the size of the advertised average class size (17) might engender those responses.

Recommendation 5. *Review the issues related to course caps and course enrollments within five years of implementation.* We focused on key aspects of the 2009 report, but did not address others. We recommend that future iterations of CEPP continue to address issues of course caps and course enrollments. Furthermore, we recommend that—if implemented—the revised course caps be reviewed within five years of implementation.

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