CU-Boulder Classroom Utilization Fall 2012
Office of Planning, Budget & Analysis
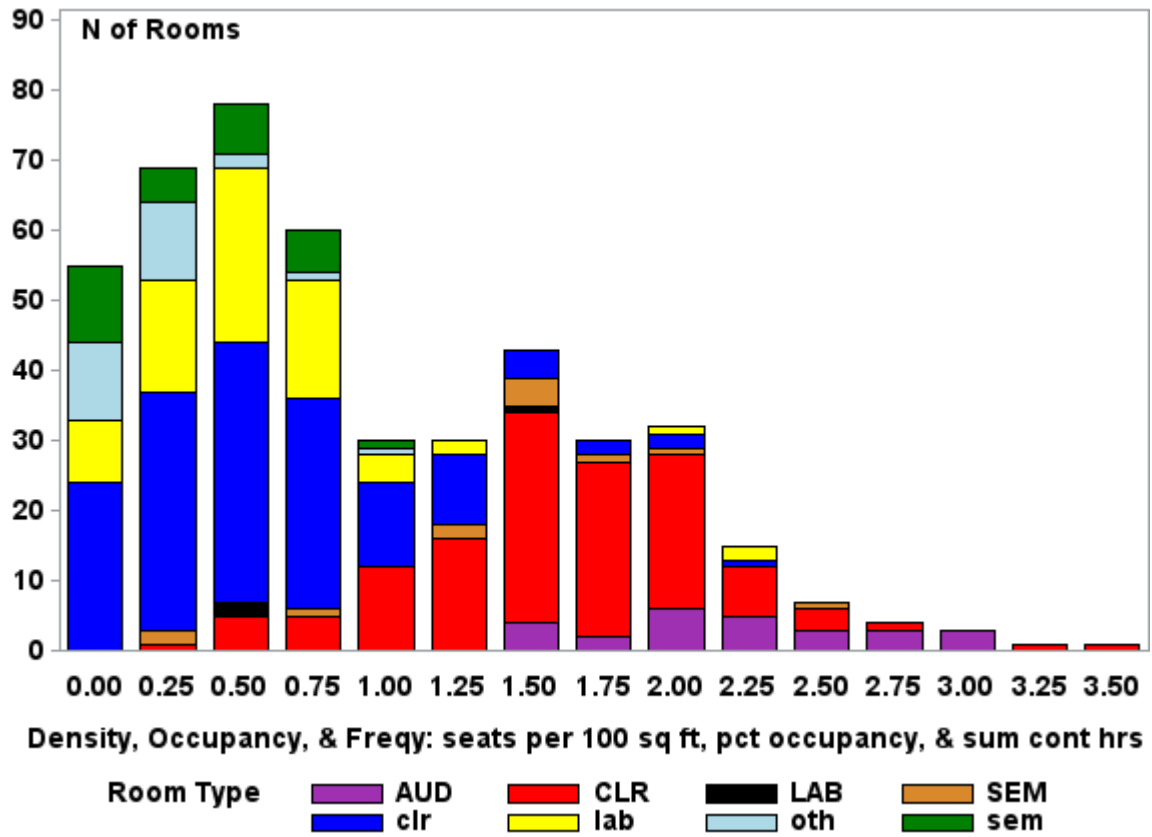Robert Stubbs, Frances Costa, Blake Redabaugh
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This report describes space utilization in fall 2012 in CU-Boulder classrooms, instructional laboratories, and other instructional space.
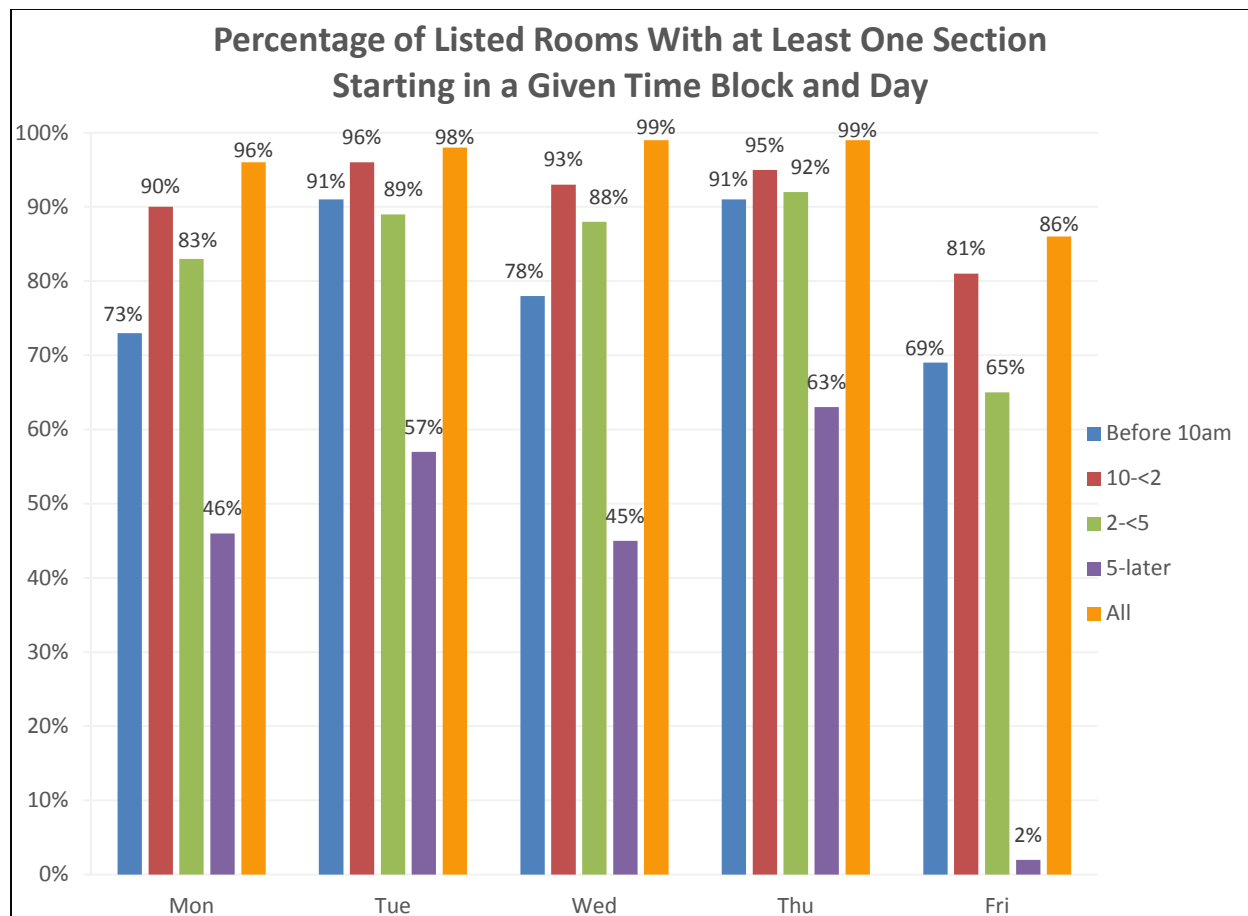
Summary of results:

In fall 2012 there were 459 rooms on the Boulder campus with instructional activity; 26 rooms were in auxiliary fund buildings, and 433 rooms were in general fund buildings. In the general fund buildings 170 rooms were centrally scheduled and 263 rooms were scheduled by departments.

The distribution of rooms over the DOF classroom use index is shown below, color-coded for room type. The DOF is generally comparable to the Classroom Use Index used in prior year reports and developed to assess extent to which classroom use met or exceeded state standards. Both indices incorporated measures of seat density (seats per 100 square feet of classroom space), room occupancy (numbers of available seats used), and use frequency (hours of classroom use). Centrally-scheduled classrooms (red) and auditoriums (purple) are almost all over 1, reflecting more intense use, i.e., more seats and/or higher occupancy and/or higher hours. Most of the rooms with indices under 1 are labs (yellow) and departmentally-scheduled classrooms (blue), which may well serve other purposes during the week. In the key, centrally scheduled rooms are in all upper case, departmentally scheduled in lower case. Types: Auditorium (all but one were centrally scheduled in fall 2012), Laboratory (including computer labs and special purpose labs), Classroom (regular classrooms and lecture rooms), Seminar Room, and Other (studio, gymnasium).

N of Rooms

Density, Occupancy, & Freqy: seats per 100 sq ft, pct occupancy, & sum cont hrs

Room Type		
AUD	CLR	LAB	SEM
clr	lab	oth	sem

As shown in the graph below, nearly all (96-99%) of the 459 listed rooms are occupied for classroom instruction during at least one time block on all weekdays except Friday, when 86% of listed rooms are occupied for class meetings. Highest instructional use of rooms occurs before 5 p.m.

Percentage of Listed Rooms With at Least One Section Starting in a Given Time Block and Day

Legend: Before 10am, 10-<2, 2-<5, 5-later, All

Day	Before 10am	10-<2	2-<5	5-later	All
Mon	73%	90%	83%	46%	96%
Tue	91%	96%	89%	57%	98%
Wed	78%	93%	88%	45%	99%
Thu	91%	95%	92%	63%	99%
Fri	69%	81%	65%	2%	86%

NOTE: "All" = Percentage of rooms with at least one section on a given day (regardless of time block).

Background:

Key constituencies for these data are
- The Boulder Registrar's Office, which handles classroom scheduling for most main campus courses.
- The Office of Facilities Management, which maintains and updates the campus space inventory. Space data used in this analysis are from August 2012. Any building or room naming or classification discrepancies default to course data to match previously published course catalog information.
- Teresa Osborne, CU-System Director of Capital Assets, for use in conjunction with reviews of capital construction budget requests by the Regents and by DHE/CCHE (State of Colorado Department of Higher Education, Colorado Commission on Higher Education).

Prior analysis and changes since fall 2010:

Reports similar to this for data from fall 2006, fall 2007, and fall 2009 are available at http://www.colorado.edu/pba/course/UCBClassroomUse.htm. There are no reports for fall terms 2008, 2010, or 2011.

Data from the fall 2012 analysis are not directly comparable to those reported in prior space analyses due to

- changes in rooms under analysis: Current report includes rooms with at least one hour of scheduled instruction per week, rather than rooms with 20 or more hours of scheduled instruction per week
- changes in source data systems: Current report uses CU-SIS database rather than SIS database
- changes in methodology: Earlier reports used indicators based on DHE/CCHE classroom space utilization guidelines. DHE/CCHE has since repealed the utilization standard. Fall 2012 analyses of classroom space use at CU-Boulder used a new metric, described below.

Fall 2012 data are in the Excel file posted from
http://www.colorado.edu/pba/course/UCBClassroomUse.htm.
See the last section of this document for specifications. The Excel gives a brief definition of each data column plus translations of all codes used.

The Excel lists data for all instructional **rooms** in general funded and auxiliary funded buildings. Specifications and definitions used in defining the analysis set:

- The 459 listed rooms are all general and auxiliary funded buildings with any scheduled instructional activity. This includes centrally scheduled rooms and rooms scheduled by campus units

To measure fall 2012 classroom utilization we developed a metric that incorporates room seating **density**, percent **occupancy** of available seats, and **frequency** of room use. The index is conceptually similar but not directly comparable to the DHE/CCHE utilization index used in earlier reports.

Classroom utilization is a function of three independent components; all three, plus the summary index of overall classroom use, are shown in the Excel.

- **Density:** Seats per 100 square feet
  - Higher numbers indicate more intense use.
  - Auditoriums average 8.3 seats per 100 square feet, regular classrooms average 5.7 seats, and laboratories average 3.6 seats.
  - Square feet figures are from the facilities management database with seat values specified from CU-SIS.
  - Seats per 100 square feet = (Room Seats/Room Square Feet)*100
- **Occupancy:** Average actual enrollment per number of seats for the room
  - The higher the actual enrollment relative to the maximum, the more intense the use.
  - Actual enrollment will fall under the maximum if demand for a course is low, if time conflicts prevent students from enrolling, if no smaller rooms are available for scheduling, etc.
  - Average actual enrollment is calculated from course enrollments in the room. Room seat values are the maximum number of seats in the room.
  - Average actual enrollment per number of seats for the room = Average Course Enrollment/Room Seats
- **Frequency:** Total scheduled hours over all courses for the room in a week
  - The higher the hours, the more intense the use.
  - Calculated variables from course start time and end time multiplied by course meeting pattern (e.g., MWF)
  - Total scheduled hours over all courses for the room in a week = Sum of course contact hours for each room per week.

Classroom utilization index: Called **"DOF"** (**D**ensity/**O**ccupancy/**F**requency), the index is a summary measure of room seat density, room occupancy, and frequency of use**:**
- Higher numbers indicate more intense space and time use.
- DOF = (Density * Occupancy * Frequency)/100
- Ranges from 0.01 to over 3.5

Outline of results: Below is a discussion of findings on classroom utilization: those on the separate components of classroom use and those on the summary index of classroom space use. First, we present findings on the types of course sections taught at CU-Boulder (lecture, lab, etc.), instructional rooms and their characteristics (room type, square feet, etc.), and measures of instructional activity in rooms, including sections and hours per week scheduled, maximum scheduled enrollment, actual enrollment, and average occupancy. Second, we present findings from a summary index of classroom space use that assesses intensity of seat density, classroom occupancy, and classroom use frequency (the DOF Index).

Results - Components of Classroom Use
- Course sections In fall 2012 instructors at CU-Boulder taught over 4,800 course meeting patterns (e.g., ASTR 5540 001, MWF 10 TO 11, DUAN Room E126). We have labeled the discrete meeting patterns "sections" for this analysis.
    - 51% are lecture sections. Over 70% of these meet a total of 3 hours per week in two or three class meetings, generally Tuesday-Thursday or Monday-Wednesday-Friday.
    - 19% are recitation sections. Over 90% of these meet once a week for one hour.
    - 14% are lab or main-lab sections. These generally meet 2-4 hours 1-2 times per week.
    - 11% are seminars. These have widely varying meeting patterns.
- Rooms and room characteristics
    - 459 classrooms and labs are listed in the Excel. This number is higher than that in the previous space analysis because the earlier analysis included only rooms that were used at least 20 hours per week. Of the 459 rooms, 26 are in auxiliary funded buildings and 433 are in general fund buildings.
    - The listed rooms have a room classification on CU-SIS and in the facilities management database. We used the classification from CU-SIS because this is the source of record for instructional activity. Sixty-two percent are regular classrooms or lecture rooms. Other types are auditorium (6%), seminar room (9%), laboratory/computer lab/special purpose lab(17%) and studio (5%). Two listed rooms are gymnasiums. The average number of seats varies dramatically with room type: 24 for seminar rooms, 31 to 36 for laboratories, 46 for classrooms, and 190 for auditoriums.
    - The great majority of rooms used for instruction at CU-Boulder (N= 366, 80% of instructional spaces) seat 50 or fewer students. All seminar rooms and most of the lecture rooms, regular classrooms, laboratories, and studios are in this group. Thirteen percent of rooms (N=59) can seat 51-100 students. Most of these are classrooms (N=43), labs (N=7), or auditoriums (N=6). The remaining 34 rooms (21 of which are auditoriums) seat more than 100 people.
    - Facilities management data include the square footage of all rooms. Seats per 100 square feet ranges from 0.5 in one laboratory to 17.1 in an Engineering Center classroom.
    - Each room is designated as centrally scheduled or not. The Office of the Registrar controls central room scheduling with input from the instructor or department. All centrally scheduled rooms are in general fund buildings. Only more generic rooms are centrally scheduled; those with layouts or equipment for a single department (e.g.,

       chemistry) are not. Of the listed rooms, all auditoriums, 77% of "classrooms," about half of seminar rooms, and no labs or studios are centrally scheduled.

- Course sections in rooms Results are for rooms listed in the Excel except as noted.
  - Total scheduled hours per week
    - All rooms but one are scheduled for up to 68 hours per week of instructional use; those with the highest scheduled use are classrooms in Duane Physics, Engineering Center, Economics, Hellems, Eaton Humanities, Macky auditorium, and Muenzinger auditorium. One classroom in Environmental Design has 90 scheduled hours.This is a function of course scheduling and room design and may not reflect actual weekly use.
    - Listed rooms are scheduled an average of 27 hours per week. In general fund buildings, classrooms are scheduled 32 hours per week, auditoriums are scheduled 39 hours, seminar rooms 20 hours, and laboratories for 20 to 22 hours per week. These numbers are lower than those reported for fall 2009 due to the inclusion of auxiliary buildings and no specified minimum activity threshold.
    - Labs likely have lower scheduled use for two reasons. First, all have specialized equipment suitable only for classes in one or two departments. Second, students enrolled in scheduled lab sections may opt or be required to use lab equipment outside hours scheduled for instruction.
    - Over all rooms with scheduled instruction, centrally scheduled rooms average 38 hours per week while all others average 21 hours per week. This difference is a function of several factors:
      - Some rooms that are not centrally scheduled have functions other than instruction – they are theaters, lounges, conference rooms, etc.
      - Some are actually scheduled with classes that are specified on CU-SIS only as "see department"–such assignments are not available for analysis.
      - Some are rooms with specialized equipment suitable for only a few classes.
      - Some are at long walking distance from the rest of campus or have other scheduling or use issues.
- Percent occupancy, averaged over sections, per maximum number of seats in the room.
  - The higher the maximum enrollment relative to the number of seats, the more intense the use.
  - Maximum enrollment cannot be more than the number of seats. It will fall under the number of seats if no smaller rooms are available for scheduling.
  - For the listed rooms, median maximum scheduled enrollment as percentage of seats is 78%. This falls under 67% for 29% of these rooms, under 50% for about 10%. These numbers are very similar to those reported for fall 2007.
  - The greater the number of seats, the lower the maximum scheduled enrollment as a percentage of seats.
- Occupancy. Average occupancy is defined as the average actual enrollment per section as a percentage of the number of seats listed as available on CU-SIS.
  - For listed rooms, average occupancy is 72% (same as in fall 2007) for centrally scheduled rooms, 73% (vs 82% in 2007) for labs, and 49% (vs 56% in 2007) for other rooms not centrally scheduled. Decline from 2007 to 2009 in average lab occupancy is an artifact of a correction in the reported capacity of room Ramaley C147 (from 18 in 2007 to 72 in 2009); as a consequence, average occupancy for Ramaley C147 changed from 389% in 2007 to 94% in 2009. Because there is a great deal of year-to-year variation in the particular non-lab rooms that are departmentally scheduled, average occupancy will also vary.
  - Occupancy over 100% occurs when actual enrollment in a section exceeds the listed room capacity. Often this is due to the instructor's granting special permission for a

few students to enroll over the enrollment maximum. Only three of the listed rooms have occupancy at 100% or over (101%).
- Occupancy <u>under</u> 100% occurs in several circumstances:
  - When actual enrollment in a section is less than the maximum allowable
  - When the room scheduled has more seats than the maximum allowable enrollment because no smaller room is available
  - When the room scheduled has more seats than the maximum allowable enrollment but is needed for a course for its equipment or facilities (wet lab in Chemistry 140, music theater room, etc.)

Results – DOF Classroom Use Index
- This measure is a function of seat density (seats per 100 square feet of classroom space), room occupancy (numbers of available seats used), and use frequency (hours of classroom use) of all instructional areas.
- Higher numbers indicate more intense use.
- This measure is indexed so that a score of "1" indicates classroom use standards that meet or exceed those formerly established by DHE/CCHE.
- In the index, higher hours can compensate for lower occupancy (and vice versa), and more seats per 100 square feet can compensate for lower occupancy and/or lower hours.
- The distribution of rooms over the DOF classroom use index is shown on page 1, color-coded for room type.
- For Boulder, fall 2012, for the 170 rooms that are centrally scheduled, 88% of instructional spaces are at or above "1." Twelve percent of the 289 rooms that are not centrally scheduled are at or above "1."
  - Most of the rooms with DOF index values under "1" are labs, seminar rooms, studios or gymnasiums (labeled "other"), and departmentally-scheduled classrooms, which may well serve other purposes during the week.

Activities in classrooms not counted in analyses. The scheduled instructional activity characterized here does NOT include:
- Non-credit courses
- CU-SIS-scheduled events associated with courses, such as midterm exams and review sessions
- CU-SIS-scheduled events not directly related to credit instruction in a single course. E.g., Admissions' *Be a CU Student for a Day* program, World Affairs Conference
- Student use of labs outside scheduled class time. In our analysis in 2001 we estimated this at 0.5 hours per in-class lab hour for most departments, zero for lower-level chemistry and fine arts, and 1-2.5 hours per in-class lab hour for other chemistry, physics, theater/dance, and environmental design.
- Events scheduled by departments in department-controlled rooms, but not shown on CU-SIS. Example: dissertation proposals and orals
- Maintenance time
- Courses taught by continuing education
- Individual instruction not scheduled in a building including dissertation, independent study, and internships
- Courses offered through Colorado Mesa University

Policies and procedures: The Academic Scheduling Office, in the Office of the Registrar, schedules and controls over 150 classrooms, seminar rooms, and auditoriums on the Boulder campus. The academic scheduling coordinators schedule these rooms for *academic* reasons such as courses, review sessions, films, and midterm and final exams. Policies and practices for scheduling centrally-scheduled classrooms have evolved to fit campus needs and to take advantage of the software used for scheduling, through years of collaboration among the Registrar, associate deans, and departments.

- http://registrar.colorado.edu/staff/academic_scheduling.html has an overview of academic scheduling resources and procedures for departments and colleges.
- http://www.colorado.edu/registrar/registration-grades/classroom-scheduling/schedule-classroom shows resources for scheduling a classroom and the academic scheduling calendar.

Specifications for the data used in the analysis
- Fall 2012
- Courses taught on the Boulder campus *excluding*
  - Courses offered by continuing education
  - Courses with no designated meeting time and place; this excludes virtually all dissertation and independent study courses
- Calculate hours per week from the meeting pattern(s). A course meeting MWF 9:00-9:50 counts as 3 hours.
- Count all sections as 16 weeks. Less than 0.5% of Boulder sections meet less than the full term.
- List in the Excel all rooms with courses in general and auxiliary funded buildings scheduled for 1 or more hours per week or centrally scheduled, with enrollment and room capacity information from CU-SIS. This includes rooms that are centrally scheduled and rooms that are not.
- All enrollment data and almost all data on rooms are from CU-SIS. Room size and type for about 5% of rooms came directly from facilities management systems.
- Sections taught in the same room at the same time are counted as one section, with all enrollment included, whether they are technically cross-listed or combined on CU-SIS or not.
- hours per week are counted such that MWF (Monday-Wednesday-Friday) 9:00-9:50 counts as 3 hours.
- For Boulder, the "peak" week is in early-mid September. However, there is little variance over weeks because 99% of course sections meet the entire term. Therefore we have reported a week around fall census (mid September) only. We excluded any course sections that did not meet during the week of census (three weeks after the term begins).
- Files in L:\ir\reports\cusys\space\2013*.sas, *.docx, and *.xlsx.

Vocabulary
- Course section, or section: A time/place/instructor combination students enroll in, identified with one or more an 11-digit course ID's on CU-SIS. The course ID is comprised of course subject (e.g., HIST), course number (e.g., 1234), and section number (e.g., 100). Sections taught in the same room at the same time are counted as one section, with all enrollment included, whether they are technically cross-listed or combined on SIS or not. For example, if HIST4567 and HIST5567 are taught in the same room at the same time by the same instructor, we consider this as only one section with the enrollment of all students from both. Similar examples are of the form ENGL1234 with WMST1234, and section PSYC1001-880 with PSYC1001-100. In addition, our analyses identified courses meeting in the same room at the same time but not specified in CU-SIS as cross-listed or combined.

- Meeting pattern: A combination of building and room, days of the week (e.g., MWF), and start and end time.
- Periods: The number of separate meetings for a course section, in a week. A MWF 9-9:50 course has 3 periods.