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CLASSROOM USE AND UTILIZATION

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Classrooms are at the bottom of the campus hierarchy of space use in terms of campus square footage. At the top of the list are offices. Yet, despite their relative insignificance in comparison to other campus space uses, classrooms are a bell weather of whether or not campus space is being used well and whether or not campus space use is changing.

The third edition of *Campus Planning and Facility Development: A Comprehensive Bibliography*¹ lists nearly 50 publications on classrooms, traditional and contemporary. This list includes publications that describe classroom sizes, shapes, materials and finishes, comfort, technology, uses, and locations. However, not one of these publications analyzes the use and utilization of classrooms and how this is changing. This article seeks to fill that gap in the literature of educational facilities—how are classrooms distributed by size on a campus, how well are they used, and how their use changes with faculty and student needs and desires.

Classroom Space Use

On average, classrooms represent about 5 percent of the space on campus, excluding housing. Based on data from 25 public universities, mainly large research campuses, classrooms range from a low of 3 percent to a high of 12 percent of academic, administrative, and support space on campus, as shown in Table 1. Of the public university campuses in Table 1, those with large amounts of research and support space have the smallest percentage of campus space in classroom use. Those campuses with less research and support space have a higher percentage of their space in classroom uses, but none exceeded 12.4 percent.

Other data suggests that on average, about 16 percent of campus academic space, excluding class laboratories, is in classrooms or scheduled for instructional use among small private liberal arts colleges and universities. This is also shown in Table 1.

Table 1
Distribution of Academic, Administrative and Support Space at
27 Colleges and Universities, Excluding Housing

NCES Room Codes and Room Type	25 Public Universities		2 Private Universities Average	27 Colleges and Univ Average
	Average	Range		
100 Classrooms	5.2%	3.3 to 12.4%	15.7%	5.3%
200 Teaching Labs	7.0	4.3 to 19.5%	18.3	7.1
250 Research	15.3	8.3 to 24.1%	3.6	15.2
300 Office	22.5	11.0 to 33.1%	23	22.5
400 Library/Study	6.6	4.9 to 12.8%	17.7	6.6
500 Special Use	14.1	1.2 to 25.8%	13.3	14.1
600 General Use	11.2	4.7 to 19.0%	4.6	11.2
700 Support	14.4	5.4 to 26.7%	0.5	14.3
800-900 Health Care/Residential	<u>3.7</u>	0.9 to 5.5%	---	<u>3.7</u>
Total	100.0%		100.0%	100.0%

Source: Fa Pink and Associates, Inc., based upon data from 25 Public Universities and two Private Universities

Excluding residential facilities, which on some campuses represent one-half of all square footage, offices are the largest users of space. They are followed in the campus hierarchy of space use by research space; by special use facilities, including athletics and recreation; by support facilities, including central services; by general use facilities, including assembly and food services; and then by teaching or class laboratories and libraries. At the end of the list of space use, based on campus square footage, are classrooms.

Understanding Classroom Utilization

This article is based on a number of studies we have conducted to measure classroom utilization at campuses across the United States over the past decade. These campuses include private and public, small and large, urban, suburban and rural. The list includes, for example, the George Washington University, the University of Missouri at Kansas City, the Georgia Institute of Technology, Thomas Jefferson University, John Kennedy University, Denison University, St. Mary's College of California, and the University of North Dakota.

Each of these campuses is in a unique setting and each has its own culture. As a result, each classroom analysis had a different result. These differing results have added to our knowledge of how classroom use is changing. However, the campuses are similar in how they help us understand the distribution of classrooms by size, area per station, and utilization.

Legislative Focus on Classrooms

Many universities face space shortages. Legislative bodies often focus on classroom use, mandating higher and sometimes unreachable expectations of use, in the belief that better use of classrooms would solve those space problems. According to the 1989 California Postsecondary Education Commission Report, *Survey of Space and Utilization Guidelines in the Fifty States*, prepared by MGT Consultants, 26 of the 50 states have guidelines or expectations of classroom use. For example, in public higher education in California, mandated classroom utilization, which is the most restrictive in the nation, is based on use over a 70-hour week, with the expectation that classrooms should be in use from 8:00 a.m. to 10:00 p.m., five days a week.

In reality, it is not possible to use classrooms every hour of the day. First, classroom capacity on all campuses, when simply measured by the multiplication of rooms times the number of stations in the rooms, times the number of hours available for classroom use, would greatly exceed the demand for instructional space. Second, the use of classrooms on many campuses is a market

commodity. Unless the campus is highly restrictive in its scheduling, students as well as faculty show preferences for the times of day or evening, and days of the week, they want to be in the classroom. When a campus which is experiencing growth has a shortage of classroom space, or simply wants to reallocate classroom space to other uses, a careful look at the utilization and scheduling of existing classrooms becomes important.

Even if classrooms were in use every hour of the day, as some legislatures expect, the impact on space needs on campus would be negligible. For example, in the University of California system, classrooms and classroom-related space represent only 5 percent of the academic and administrative space inventory. Higher levels of classroom use would have a minor effect on space on campus.

Even with this limited influence, there are still important opportunities to gain better use of instructional space. The first step in achieving better use of classroom space is by measuring and classifying the space to gain an understanding of classroom use and utilization.

ANALYSIS OF CLASSROOM SPACE AND USE

General Purpose Classrooms

For purposes of classroom analysis, "General Purpose" classrooms refers to the basic classrooms owned and maintained by the university, rather than maintained by an individual academic unit. Usually, the registrar's office manages the campus inventory of generalpurpose classrooms. For purposes of data consistency, these are rooms that would be classified as NCES Room Codes 100 to 1992.²

Classroom Scheduling

Classroom scheduling at most campuses begins with the process of distributing instructional rooms for use in an upcoming term based upon their distribution and use in a prior term. Today there are proprietary computer algorithm programs available to assist campuses in allocating and scheduling classrooms. Still, at many campuses, classroom scheduling continues to be done manually rather than with an automated scheduling system, in the ongoing effort to match course needs to classroom inventory.

Generally, an academic department reviews its prior term scheduling (including room and building) in comparison to their upcoming course offerings and advises the registrar of any needed change. The requesting faculty identifies the maximum number of students to be accommodated in the course they are offering, the type of room, and their preference for course time of day and days of the week. Where there is an apparent need for change of a classroom, the classroom allocation schedule is revised; where there are no changes, the classroom allocation stays in place from one semester to the following semester. With it, remains the built-in scheduling inefficiencies based on what can be considered a human desire to travel the shortest distance from office to classroom and to teach at a time and place of one's choosing.

Room Scheduling Policy

At many campuses there is no room scheduling policy. There are no classroom committees to oversee the allocation process or assist in seeking scheduling efficiencies. There is also limited activity in terms of enforcing class starting and ending times, or working to optimize the use of the classroom inventory, or setting the campus tone on classroom use and instructional outcomes, i.e., student productivity. The lack of policies and the inherent difficulties of classroom scheduling can lead to inefficient classroom use.

One important policy for a campus to enforce, if it seeks to have efficient use of its classrooms, is that of standard course meeting times. Classes would be expected to start on the hour and extend for 50 minutes. But, at many campuses this policy is not followed. As described later in this article, when class starting or ending times differ from standard meeting times, the result is a

classroom schedule as a matter of accommodation rather than optimization. In the process, the efficient allocation of classroom resources is hampered.

Sources of Classroom Data

The first step in seeking greater classroom utilization is based on accurate and comprehensive data. The information and analysis of classroom use should be based on two sources. The first is the campus facilities database used to provide baseline data about the classroom inventory at a campus. The second source is the campus registrar's course record.

The facilities database identifies the type of classroom and its station count. The registrar's records are used to compute weekly room use hours (the number of hours per week a room is in use), and the average percentage of student station occupancy (the average percentage the seats are occupied during any given hour). These two measures are used to measure classroom utilization.

Once raw course-by-course data is provided by the registrar, it can be used as input in a classroom use relational database, and the data tabulated to develop a profile of classroom use (occupancy) and utilization (number of stations occupied during the week).

Distribution of Space by Room Type: An Example

Table 2 describes a typical institutional classroom, seminar, and lecture space inventory and quantifies it, based on the one campus facilities database.

As shown in Table 2, at this campus there are 55 classrooms (NCES Code 111) and 19 classroom service support rooms (NCES Code 115) (storage, closets, projection booths, etc.) which together total nearly 35,000 assignable square feet (ASF).

Room Type and NCES Code	Number of Rooms	Range of ASF* per Room	Number of Stations (range)	Number of Stations (total)	Average Number of Stations Per Room	Total ASF	ASF per Station
Classrooms (111)	55	267 - 898	4 - 80	1,916	35	32,042	16.7
Lecture Rooms (112)	48	314 - 4,071	24 - 455	3,471	72	50,364	14.5
Classroom Service (115)	19	24 - 810	0	0		2,476	-
Seminar Rooms (120)	100	140 - 877	1 - 28	1,453	15	34,175	23.5
Seminar Service (125)	4	29 - 443	0	0		595	-
Technology Classrm (130)	3	185 - 1,734	3 - 88	137	46	2,786	20.3
Distance Educ (140)	3	928 - 1,340	49 - 120	249	75	3,451	13.9
Distance Education Service (145)	2	93 - 212	0	0		305	-
Computer Classrooms	8	438 - 905	24 - 34	231	29	5,098	22.1
Total	242			7,457		131,292	17.2

Source: Ira Fink and Associates, Inc.
*ASF = assignable square footage.

The 48 lecture rooms (NCES Code 112) total 50,400 ASF. Lecture rooms are identified in the database as large lecture classrooms, although some may have a stage or even entry vestibules. They often have fixed, rather than movable, seating.

The 100 seminar rooms in the inventory (NCES Code 120) total more than 34,000 ASF. Seminar rooms are identified in the database as rooms furnished with a conference type table with seating around the table. Enrollment in seminar courses is usually limited to 20 or fewer students, although some seminar rooms seat more.

One factor that is instructive about this data is that at this campus about one of five classrooms and lecture rooms have a companion classroom service room (NCES Code 115) that supports or

provides service to these rooms. These could be rooms used for storage, equipment, controls, etc.

Classroom Space

Altogether, there are 131,292 assignable square feet devoted to instructional (non-laboratory) space in the Table 2 example, including classroom service space. With a total academic facilities inventory of 1,340,968 asf in buildings primarily used for academic purposes (excluding most athletics, recreation, student union and housing), at the campus in this example, the instructional classroom class space, including classroom service space, is about 9.8 percent of total space use.

Classrooms (NCES Codes 100 through 199) at St. Mary's College of California represented 14.3 percent of academic and administrative assignable square footage; at Denison University, they were 16.9 percent; at Georgia Tech, they were 10.1 percent; at George Washington University, 9.9 percent; at the University of North Dakota, 12.4 percent; and at the University of Missouri at Kansas City, 9.8 percent.

As the data in Table 2 show, the amount of classroom space at the larger campuses is in the range of 10 percent of all academic, administrative, and support square footage. This is due in part to a significant amount of campus space being devoted to research and research-related space, which helps to dampen the relative proportion of classroom space. At the smaller campuses, classrooms average about 16 percent of square footage, which is an illustration of the opposite effect. Without considerable space devoted to research, classroom space increases in relative importance as a space use on small liberal arts campuses.

Classroom Station Size

The size of a classroom, when measured in area per station, is a function of the type of furniture in the room. Lecture halls, with fixed seating and defined aisles, take up the least amount of square footage per student station. Movable tablet arm chair classrooms also take up a modest amount of space per station, but more so than lecture halls. Seminar rooms with fixed tables, or even movable tables and loose chairs, take up the most square feet per student station. The size or square footage area of a student station in a classroom is an important measure to know and understand when programming new classroom space or reallocating existing space.

Among the folklore of higher education that I have been trying to dispel is that the size of a classroom student station is 15 square feet. While this may have worked for high schools in New York City in the 1920s, where it originated,³ it does not work for higher education today. Generally, higher education classrooms with movable tablet arm furniture average between 18 to 22 assignable square feet per station. Fixed-table rooms that are Americans with Disabilities Act (ADA) compliant require 35 to 40 assignable square feet or more per station since both tables and an instructor's podium take up considerably more space per station than movable furniture, and the room must accommodate and allow a person in a wheelchair to move freely about the room.

As shown in Table 2, classrooms in the campus listed had an average of 35 stations per room and an average area of 16.7 square feet per station. Lecture rooms had an average of 72 stations per room and an average area of 14.5 square feet per station. Seminar rooms had an average of 15 stations per room and an average area of 34.2 square feet per student, an indication of the amount of space the central seminar table occupies in the room.

Classroom Size by Number of Stations

A second important measure of classrooms is the number of student stations in the room and the distribution of rooms by station size.

For comparison purposes, Table 3 describes the distribution of classrooms by the number of stations on five campuses. Among the 703 rooms in the table, there is an average of 42 stations per room. Among the five campuses shown in Table 3, the average classroom size varies from 30 stations per room to 61, with the three public universities having the largest average number of stations per classroom and the two private liberal arts colleges the fewest.

Table 3
Classroom Distribution by Station Count, Various Campuses

A	B	C	D	E	F	G
Classroom Stations	Public University	Public University	Public University	Private University	Private University	TOTAL
0 to 9	5.0%	0.0%	2.0%	0.0%	7.6%	3.0%
10 to 19	32.2	1.3	14.3	7.5	21.5	17.4
20 to 29	19.3	8.7	15.3	34.0	34.2	18.6
30 to 39	15.1	21.3	25.1	47.2	16.5	21.8
40 to 49	11.9	24.7	18.2	9.4	12.7	16.4
50 to 74	7.8	28.0	14.8	1.9	3.8	13.2
75 to 99	1.3	6.7	4.4	0.0	1.3	4.3
100 to 249	3.2	5.3	5.9	0.0	1.3	4.0
250 or more	0.9	4.0	0.0	0.0	1.3	1.3
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Total Rooms	218	150	203	53	79	703
Total Stations	7,457	9,141	8,939	1,591	2,571	29,699
Stations/Room	34	61	44	30	33	42
F-T Headcount	11,500	13,000	9,600	2,200	2,100	38,400
Stations/Full-Time Headcount	0.65	0.70	0.93	0.72	1.22	0.77

Source: Ira Fink and Associates, Inc.

Distribution of Classrooms by Number of Stations

Classroom station count has considerable importance in the utilization of classrooms and use of faculty resources. If the instructional program and pedagogy allows for large enrollment courses, and if rooms with large seating capacity are available, large enrollment classes are offered. If the rooms to accommodate the large enrollments are not available, a course is divided among smaller rooms, with a replication of the course in smaller sections, and with more faculty resources devoted to teach the course.

As an example of the average distribution of rooms by number of stations (seats) in classrooms on five campuses, the data in Table 3 show 20 percent of the rooms have 19 or fewer stations, 19 percent have 20 to 29 stations, 22 percent have 30 to 39 stations, 16 percent have 40 to 49 stations, 13 percent have 50 to 74 stations, 4 percent have 75 to 99 stations, and 5 percent have 100 or more stations. Overall, almost 61 percent of the classrooms have 39 or fewer stations.

In Table 3, only one of the campuses had more than 40 percent of its instructional space in classrooms with 50 stations or more. One campus had about 15 percent of rooms that seat 50 or more, another had about 25 percent, while the two private campuses had, on average, less than 5 percent of space in classrooms seating 50 or more students. In fact, on one private campus, the largest classroom had only 72 stations. The campus with more than 40 percent of its classroom inventory in large rooms, more so than the others, would have the capability to offer larger enrollment courses, which often occurs in introductory or survey courses.

At one of the two private universities shown in Table 3, more than 98 percent of the classroom space had 49 or fewer stations per room. At the smaller end of station count, 42 percent of the classroom had fewer than 29 stations. While the smaller classrooms are an indication of a higher student to faculty ratio at this campus, it did not allow the campus to offer large lecture courses, sponsor large presentations, or enjoy economies of scale in its instructional program.

Classroom Station Capacity Analysis

Classroom station capacity data illustrates three main points about classrooms on campus: first, the large number of rooms on most campuses that seat 49 or fewer students (in the Table 3 example shown, this applied to more than 75 percent of the classrooms); second, the relatively modest number of rooms on campus that seat 100 or more (about 5 percent), that will be important to replace should they be lost through conversion to other uses or replacement; and third, the difficulty in finding a room on many campuses to stage lectures or other assembly activities of 250 or more persons (which averaged 1 percent of classroom inventory).

While the demand for large rooms is not continuous during the week, there is usually a level of interest on most campuses in having programs with a sizable audience and thus a demand for some large rooms. Since there is often a need to convert classrooms to technology-laden spaces, it is important for campuses to maintain, enhance, or add to the large lecture room spaces they have, either as lecture space or as multi-purpose instructional and assembly space. Once a campus converts the large instructional rooms to technology-rich rooms, they are seldom returned to lecture-type use.

Station Count per Student Headcount and Classroom Utilization

To help gauge classroom efficiency and utilization, I developed a measure of station count per student head count and compared this result to campus classroom utilization. As shown in Table 3, the station per full-time headcount varied from a low 0.65 stations per full-time head count at one campus to a high of 1.22 stations per head count at another. This variation between campuses is significant, because it provides one direct measure of classroom capacity in relation to enrollment.

As a rule of thumb, if a campus classroom station count exceeds one station per student, there is too much classroom space. Think about it. If a campus had, in inventory, one classroom station for every full-time enrolled student, then every student could be in class at the same time. If this were to happen, all instruction would be complete in a few hours per day, a few days per week, and the classrooms would be empty the remainder of the time.

Since empty classrooms already occur, a measure of classroom station count in the range of 0.75 classroom stations or fewer per full-time daytime enrollment would indicate opportunities for a better allocation of classroom space on a campus. If a campus greatly exceeds the range of 1.0 stations per full-time student, or even 0.75 stations per full-time student, the administration should look to reallocating classrooms to other uses, especially if there is a space crunch.

To test the efficacy of this measure, I used data from Table 3 and from Table 4 (shown in the next section) and compared the two results. Surprisingly, the campus with the lowest number of classroom stations per full-time head count (0.65) also had the lowest daytime classroom utilization (39.3 percent). This is an indication of considerable excess daytime classroom capacity due to large rooms and low course enrollments, as well as fewer classes scheduled on Fridays in comparison to the remainder of the week. The campus with the highest number of classroom stations per head count (1.22) had a moderate level of classroom utilization (65.2 percent). This, however, was based on a 40-hour classroom week used by this campus. If a 45-hour classroom week had been used, this would have resulted in a lower utilization rate of 56.7 percent. While these results could not have been forecast in advance, the data from Table 3 and Table 4 add empirical evidence to the importance of finding the right balance of classroom space on a campus to gain a higher level of classroom utilization.

Table 4
Classroom Utilization by Building, 8 a.m. to 5 p.m., 5 p.m. to 10 p.m.

A	B	C	D	E	F	G	H	I
Campus Type	Times of Use	No. of Rooms	Total Stations Available	Total Adjusted Classroom Hours Available	Total Hours in Use	Adjusted Available Student Contact Hours	Actual Weekly Student Contact Hours	Room Capacity % Util.
Private Units	8:30 am - 4:30 pm	106	2,442	2,881	1,090	39,267	25,610	65.2%
Private Units	8 am - 5 pm	61	2,234	1,899	1,523	40,415	28,827	71.3%
	5 pm - 10 pm	61	1,667	1,053	493	16,753	6,773	40.4%
Public Units	8 am - 5 pm	149	2,240	4,492	2,210	130,972	51,426	39.3%
	5 pm - 10 pm	128	3,389	2,084	1,086	54,150	18,605	34.3%

MEASURING CLASSROOM USE

Instructional Class Period

Classes at most universities have a similar methodology for defining an instructional period and scheduling classes. Most class scheduling occurs in one-hour increments on Mondays, Wednesdays, and Fridays. A class scheduled as one hour is actually in session for only 50 minutes. Classes normally begin on the hour and end at ten minutes before the hour allowing for nine separate one-hour instructional periods between 8:00 a.m. and 5:00 p.m. On Tuesdays and Thursdays, the class period is usually 90 minutes long. At most colleges and universities, this format would mean 75 minutes of class session and a 15-minute break between classes, allowing six separate 90-minute instructional periods to be scheduled.

I do not know how or where the Monday-Wednesday-Friday or Tuesday-Thursday instructional formats of class periods originated. I also do not know if pedagogically they are good. Perhaps longer instructional periods, or fewer days in class, or both, would be better in terms of student outcomes. As illustrated in the data that follows, on at least one campus, the traditional instructional class period is changing.

Ending Times of Classes

While we expect the registrar's class record to show a traditional class schedule, what we found unique in one classroom utilization study was not the variation in class starting times, which occurred at 8:00 a.m., 9:00 a.m., 10:00 a.m., etc., but the number of different class ending times.

For example, in addition to the expected nine standard class start and class end time frames on Monday, Wednesday and Friday on this campus, there were 12 other class end times. A class could end at 0:50, 0:55, 0:00, 0:05, 0:10, etc. On Tuesday and Thursday, in addition to the expected six regular daytime class start and class end times, there were 26 other class end times.

While such scheduling is likely to accommodate the faculty and course needs, it plays havoc in establishing a continuous use of instructional space. If, for pedagogical reasons, a class requires more than 50 or 75 minutes of continuous in-class instruction, than it is useful to look at alternative course scheduling which would allow for longer course periods, so long as the next scheduled course to use the room also had need for a longer instructional period.

Starting Time of Classes

In another classroom utilization study, in addition to the nine regular daytime class start times, there were 51 other start times to classes. At this campus, the scheduling of classes, which was done by hand, had become so faculty and course specific, that not only could a class start on the hour, but also at five minutes past the hour, ten minutes past the hour, fifteen minutes, etc. The result was usually an unscheduled or unusable class time during the hour period following the class with the non-standard start (or ending) time. This meant an empty room for the remainder of the hour, and a room that could not be rescheduled until the start of the next full hour.

Effect of Non-Uniform Class Start and End Times

The effect of excessive non-uniform class start or end times throughout the week means that one class is continuing to use a room, thereby preventing another class from being scheduled at a regular start time, leading to lower utilization. Enforcing the criteria that all Monday-Wednesday-Friday, as well as Tuesday-Thursday classes have the same start time (and end time) results in higher classroom efficiency and in gaining additional classroom space without the need to add classrooms.

The campus with the myriad of start times was also finding a reduced number of classes scheduled on Fridays. A policy recommended for this campus at the end of our study would require that a target of 50 percent of the instruction be scheduled during the day, 40 percent in the evening and 10 percent on Fridays, in an effort to use classroom resources more effectively.

The Hour-Long Class

In an interesting contrast, classes at St. Mary's College of California have, by policy, a scheduled instructional period that is longer than at most colleges and universities. A one-hour class actually lasts for an entire 60 minutes, followed by a 10-minute break period for movement to the next class. The St. Mary's academic calendar is divided into eight standard time frames of 8:00 a.m. to 9:00 a.m., 9:10 a.m. to 10:10 a.m., 10:20 a.m. to 11:20 a.m., 11:30 a.m. to 12:30 p.m., etc. This occurs on Mondays, Wednesdays and Fridays.

On Tuesdays and Thursdays, the St. Mary's class period is exactly 90 minutes long. Whereas at other colleges and universities this would mean 75 minutes of teaching and a 15-minute break, at St. Mary's the course is 90 minutes with a 15 minute break between classes. The faculty at this college feel that the additional class time is needed to cover the course material.

Monday-Wednesday Only Classes

One other anomaly of class schedules is the unusual practice of not scheduling classes on Friday. For example, on one campus we identified 149 different daytime courses that met only two times per week.

However, the 149 two-time per week meeting in this example were not Tuesday and Thursday classes, but rather classes that met only on Monday and Wednesday. While this has the

immediate impact of causing empty classrooms on Friday, the negative impact at this campus was offset to a degree by another set of classes scheduled to meet only on Fridays, or in some cases on Fridays and Saturdays. Without replacement courses in a Friday only schedule, the two meeting per week, Monday-Wednesday only class schedule, greatly reduces classroom efficiency.

A second negative impact from classes that meet only Monday-Wednesday, instead of a traditional Monday-Wednesday-Friday, is that the faculty did not conduct the Monday-Wednesday only classes in a one-hour time slot. They conducted their two day-per-week daytime classes in time periods that extended anywhere from 50 minutes, to 1 hour and 15 minutes, to 2 hours and 45 minutes. If this happened often enough, instead of being able to schedule up to nine 1-hour classes on Monday-Wednesday-Friday, the class day would allow only six or fewer 90-minute classes per day. The total result to a campus would be a loss of one-third of the daily classroom station capacity.

While it may be nice to teach only two days a week, the cost to the campus in terms of utilization of classroom resources does not appear to make this a desirable situation. Alternatively, two day-per-week classes may be a better approach pedagogically, in which case the entire method of scheduling and utilization would need reexamination.

One Day per Week Classes

At this same campus, the registrar's record showed a fall course schedule that totaled 1,508 different courses. Of this schedule, 208 courses (16 percent) were scheduled in the evening (starting at 5:00 p.m. or later), and 1,300 (84 percent) were scheduled in the daytime. Of the daytime schedule, 237 courses (18 percent) were considered traditional one-hour long Monday-Wednesday-Friday classes.

What was surprising is that the course schedule, in addition to 149 Monday-Wednesday only classes, also included 407 daytime courses (31 percent of all courses) that met only one day per week, anywhere from 50 minutes to 2 hours and 45 minutes. It is possible that some of these courses met more than once per week, but at different times, thus appearing in the record to meet only once.

While one- or two-day classes per course are not an efficient use of classroom space, it is an occurrence that should not necessarily be dismissed. Perhaps there are pedagogical or even market reasons for its increasing occurrence. Cynically, it would be possible to conclude that it is simply accommodating some of the faculty's desire to be on campus fewer days, or, it may be an effective use of classroom time.

Evening Programs

At city universities, programs in some schools, particularly education, are evening rather than daytime programs and begin at 4:30 p.m. But city universities are not alone in this. Even the education programs at St. Mary's College of California, a suburban residential college, start at 4:30 p.m. as do the graduate programs in education at the University of North Dakota, a somewhat rural area of limited population spread over a large geographic area.

While a 4:30 p.m. class start is an accommodation to those students who are employed and need to attend in the evening, the result is that some day courses that might have been scheduled to begin at 4:00 p.m. cannot occur in rooms that will be used for evening programs. Most academic department evening programs, other than education, begin at 5:00 p.m. or 5:30 p.m. and do not affect the daytime schedule.

Evening Schedule

In contrast to the typical three meeting daytime Monday-Wednesday-Friday course schedule or two meeting Tuesday-Thursday course, evening courses are often specially designed to meet

only one evening during the week. For example, on Mondays at one campus there were 44 classes that meet only once per week on Monday evenings, usually for two hours and 45 minutes, either from 6:00 p.m. to 8:45 p.m. or from 7:00 p.m. to 9:45 p.m. On Tuesdays there were 55 classes that meet only on Tuesday evenings. On Wednesdays there were 58 classes that meet only on Wednesdays evenings. On Thursday evenings there were 41 classes that meet only one day a week. And, on Fridays, there were ten scheduled classes that meet only one time in the evening. Interestingly enough, on Saturday there were 85 different scheduled courses throughout the fall semester.

Importance of Evening Programs

What is surprising is that the courses offered after 5:00 p.m. or 6:00 p.m. are a very popular meeting time; in fact, at the University of Missouri at Kansas City, the campus schedules more courses to start between 5:00 p.m. and 6:00 p.m. each Monday-Wednesday-Friday, as it does at 9:00 a.m. and 10:00 a.m. on these same days. Even campuses as distinct as St. Mary's College of California and the University of North Dakota have dozens of evening classes.

While education degree programs generally have a late afternoon start time, there are other related class schedule accommodations which are market determined as well. For example, we found one business school program that held classes only from Monday through Thursday, with none on Friday, and a few, occasional Saturday classes.

At city or urban universities, where there is a heavy evening schedule, we found in one study of a city university that 27 percent of the student contact hours were generated after 5:00 p.m. While this allowed the campus to gain considerable use of its classrooms, it also meant the custodial crew had to clean the classroom buildings more often to keep them in service for both daytime and evening classes.

Yet, despite the large number of afternoon and evening courses, in terms of frequency of class times, the majority of courses are scheduled during the daytime 9:00 a.m., 10:00 a.m., 11:00 a.m., and 12:00 noon time slots, whether it be for one day per week, two days or three days or more. While the three day, one-hour class format has existed in higher education for decades, I do not know if it is the most useful way to provide instruction, or if it too is a space planning icon that should be challenged.⁴

MEASURING UTILIZATION

Classroom Use and Classroom Utilization Analysis

Classroom use and classroom utilization are two distinct classroom measures.

Classroom use means simply that the room is occupied. This can occur through scheduled instructional use, such as for a credit course, or can be unscheduled, such as for drop-in study or for a meeting. Generally, only the scheduled assignment of classrooms is recorded at a campus and is used in a classroom utilization analysis.

Classroom utilization is a measurement of the number of stations occupied in relation to the total number of stations contained in the room.

A campus is unusual if its instructional facilities are in use continuously every hour from 8:00 a.m. in the morning until 10:00 p.m. in the evening. At most non-urban universities, daytime courses are usually for undergraduates and normally end by 4:00 p.m. or 5:00 p.m. or even earlier. At some institutions undergraduate students take courses later in the afternoon and into the early evening.

Scheduling

On most campuses, full use of classrooms would see them occupied from 8:00 a.m. to 5:00 p.m. (nine hours per day), from Monday through Friday (five days per week). This would mean there could be as much as 45 hours of scheduled classroom use per room per week.

At the same time, higher education recognizes it is not possible to schedule every instructional room for every hour of the day. It is necessary to allow for lower periods of classroom use, such as in late afternoons, or when the size or shape of a room creates a room that by its configuration may be in low demand. Today, "smart classrooms," with technology equipment built-in, are extremely popular and heavily scheduled, while aging classrooms with blackboards only are losing favor. This too is affecting scheduling and utilization.

Use or Assignment

To account for periods of no classroom use, most institutions target a percentage of available classrooms "in use" as an indication of "full use." These targets or standards can vary widely. One common goal is to target the use of 67 percent of classrooms over a 45-hour week as an indication of full room use, i.e., occupancy by one or more persons. In other words, a classroom would need to be scheduled in use for two-thirds of the 45 hours in the week, or 30 hours, to be considered in full use.

Utilization Measurements

Utilization, by contrast, is a measure of the number of stations (seats) occupied during each class period. Again, it is not possible to schedule an exact class size in every classroom because the demand for certain courses may have smaller enrollments than expected, or the faculty can place a limit on the class size, regardless of classroom capacity, or the classroom inventory itself remains fixed both in size and station count while the enrollment and courses vary from one term to the next.

As a guideline or standard, a target utilization or classroom occupancy rate of 60 percent of the seats in a room is considered full utilization. In other words, a classroom is considered to be fully utilized if 60 percent of the stations are occupied over the duration of the instructional week, although on at least one campus, the target is 75 percent classroom station occupancy.

Classroom Utilization Model

To compute actual classroom use and utilization, we use a classroom utilization model based on data from a registrar's office as input. To test utilization, we run the data using the utilization and use factors noted above. The first factor is a scheduled use of rooms of 67 percent, or classrooms in use 30 hours of a 45-hour week (Monday to Friday, 8 a.m. to 5 p.m.). The second factor is a scheduled 60 percent occupancy of the stations in the room, e.g., 60 percent occupancy of all stations in a room means the classroom spaces are fully utilized. This is accounted for by measuring classroom contact hours in comparison to classroom capacity. The model is as follows:

1. Each registrar-scheduled course is entered into a relational database from the registrar's printed record which includes Building Name, Building Room, Course Number, Days of the Week of Course Meeting, Course Starting Time and Ending Time, Course Enrollment, and Course Capacity. (Normally, room capacity is fixed by the physical characteristics of the classroom and its designated station count. Course capacity is different than room capacity in that a faculty can limit the course enrollment, which has the effect of reducing the academic station count in the classroom while the room capacity remains fixed.)
2. This digital file is then used as input to a second program that converts the starting and ending class times to a 24-hour clock, calculates the elapsed time of each class and adds ten minutes or fifteen minutes to account for class change times, or in other words, to

make a 50-minute class equal one hour and a 75-minute class equal to one and one-half hours.

3. This second data file is then sorted to consolidate and aggregate or sum the information by individual classroom by day of the week. This allows a computation to be made of the number of hours per day a classroom is scheduled for use in comparison to the number of hours the room is available for use.
4. Next, a computation of utilization is made to compare classroom station utilization (course enrollments or contact hours) to classroom capacity. We divide the actual total student contact hours by the total classroom hours available to arrive at classroom utilization.

Daytime Utilization

The models run the classroom data for three time periods: 8:00 a.m. to 5:00 p.m., 5:00 p.m. to 10:00 p.m., and a combined 8:00 a.m. to 10:00 p.m. time period.

The results of a typical utilization analysis for the Monday to Friday, 8:00 a.m. to 5:00 p.m. class week using the 67 percent use and 60 percent utilization factors is summarized for three campuses in Table 4. This table shows a daytime room utilization of 39.3 percent at one public university, 71.3 percent at one private university and 65.2 at another private university.

If the instructional space on these campuses had been fully utilized with the classrooms fully scheduled for use 67 percent of the time, and with the stations in each room occupied 60 percent on average, the room utilization capacity would have been 100 percent.

What is important to note about the data in this table, is that the hours a classroom is in use is not the only indication of utilization. As Table 4 shows, it is the actual student contact hours in comparison to the available student contact hours that is the basis for the measurement of classroom utilization. The available student contact hours have been factored to account for guidelines noted above on the percentage of hours for classroom use and on the percentage of station use within a room.

One unusual finding from these studies is that at one campus the registrar's course scheduling record covered only about two-thirds of the classrooms in the facilities database. There are two explanations to this: first, a number of courses are shown and identified by an identifier of what is known as "TBA" or a room "To Be Announced." In other words the room for the course is not identified until after the start of classes, whereas the registrar's record used for the utilization analysis is the published Schedule of Courses.

Second, some of the rooms shown in the facilities database as classrooms may be in the control of departments who schedule "their" rooms, without entering them into the registrar's Schedule of Courses. Thus, they too are excluded from the utilization analysis.

Another unusual finding is that the registrar's record sometimes shows a classroom with a higher station capacity when it is in daytime, rather than evening, use. In Table 4, the registrar's record for the private university shown with both daytime and evening utilization, included a gymnasium which in the daytime had a capacity of 500 stations and an evening capacity of 30 stations. It is not clear from the record why this occurs.

Evening Utilization

When the evening programs for which registrar-scheduled space is tabulated is added to utilization, the evening utilization in the Table 4 example is very high. As shown, using a 25-hour week (five evenings per week, from 5:00 p.m. to 10:00 p.m.) and using factors of 67 percent of the rooms in use, and 60 percent of the stations in each room occupied, the utilization rate is nearly 55 percent at one public university and more than 40 percent at one private university.

Conclusion

As this discussion has illustrated, following a set pattern of class start and end times, ensuring that Monday-Wednesday-Friday classes do not become Monday-Wednesday classes, or even Monday only classes, and matching classroom to class size can all serve to increase the level of classroom scheduling efficiency and classroom utilization.

If the goal is one of increasing classroom utilization through better allocation of a campuses resources—both space and money—more efficient classroom scheduling is an answer. If increased classroom utilization occurs, low use classrooms can be converted to meet other campus space needs. In addition, the savings can also be applied to classroom improvements to make the remaining classrooms more technologically sophisticated or by improving the furniture and furnishings in the rooms.

If, on the other hand, higher student productivity is the goal, than a campus needs to test whether the traditional scheduling models are the best response. Perhaps classroom schedules should be more market driven or more accommodating to faculty and student time preferences. If so, it is possible that alternative scheduling models in terms of length of instructional period or days of the week, with fewer, but longer instructional periods, may be a better idea.

References

¹ Ira Fink, *Campus Planning and Facility Development: A Comprehensive Bibliography, Third Revised Edition*, Berkeley, California: Ira Fink and Associates, Inc., 1998, 155 pp. See Section VIII, Classrooms and Lecture Halls, pp. 87-92.

The forthcoming fourth edition will be available for purchase from APPA Publications at www.appa.org/resources/publications.

² *Postsecondary Education Facilities Inventory and Classification Manual*. Washington, D.C.: U.S. Department of Education, Office of Educational Research and Improvement, National Center for Education Statistics, November 1992, page 125.

³ For a discussion about the high school genesis of planning standards for higher education, see, Ira Fink, "Throwing Space Standards Out the Window, Part I: Using Space Benchmarking and Faculty Headcount to Predict Space Needs," in APPA's *Facilities Manager*, Volume 14, Number 6, November/December 1998, pp. 41-42.

⁴ For a discussion about providing space on campus based on faculty head count rather than student head count, see, Ira Fink, "Throwing Space Standards Out the Window, Part I: Using Space Benchmarking and Faculty Headcount to Predict Space Needs," in APPA's *Facilities Manager*, Volume 14, Number 6, November/December 1998, pp. 41-48; Ira Fink, "Throwing Space Standards Out the Window, Part II: Using Space Benchmarking and Faculty Headcount to Predict Space Needs," in APPA's *Facilities Manager*, Volume 15, Number 1, January/February 1999, pp. 22-27, and, Ira Fink, "Benchmarking: A New Approach to Space Planning," *Planning for Higher Education*, Volume 27, Number 3 (Spring 1999), pp. 9-18.