What makes a good classroom?

Essential qualities and features based on observed student and instructor use

Gregg Sanders, AIA, LEED AP

ABSTRACT:
The role of technology in the classroom has come to dominate higher education planning discussions over the past decade. Despite this, the physical planning standards of most campuses have remained unchanged. This study was designed to observe how architectural and technological features are currently used by students and instructors in today’s classroom environment. Ten mid-sized, general purpose academic classrooms in multiple demographic and institutional settings were randomly selected for in-room observation in an effort to identify common themes, behaviors, successes and failures of today’s physical classroom space. At the same time, this study questions how implementation of technology may inform our planning to accommodate future flexibility. While some challenge the future relevance of the physical university classroom, students observed in this study stated a preference for face-to-face learning when given to option. Furthermore, evidence suggests that many technological features of today’s classroom are simply not used by instructors while others have become a basic necessity. Based on these observations, recommendations have been developed to address the minimum or “essential” elements of today’s classroom and suggest how they may inform our planning to accommodate future flexibility. The research concludes by re-defining our understanding of a flexible classroom environment and by listing features and design principles that were found to result in effective student-instructor engagement.
What makes a good classroom?

Essential qualities and features based on observed student and instructor use

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The role of technology in the classroom has come to dominate higher education planning discussions over the past decade. Implementation of technology in the classroom has significantly changed our vision of how education will be delivered in the future. Many administrators and planners predict that over the next ten years students will increasingly demand to engage the college learning environment online and in an a la carte fashion. Others question the long-term relevance of physical classroom space altogether. Yet, physical space planning standards on most campuses have silently remained unchanged. This study was designed to challenge our assumptions about how technology is currently affecting pedagogy by observing several classrooms in operation to see how they are currently used by instructors and students. The purpose was to determine what if any spatial characteristics are needed to support today’s teaching and learning requirements. What architectural and technological elements make learning and teaching more effective today? What will this tell us about planning needs in the future? What technological features are actually used in a today’s “smart” classroom, and which features are supplied but ignored? How does architectural space itself influence student-instructor engagement? This study focused on in-room observation of mid-sized, general purpose academic classrooms in multiple demographic and institutional settings in an effort to identify common themes, behaviors, successes and failures of today’s physical classroom space. Based on these observations, recommendations have been developed to address the minimum or “essential” elements of today’s classroom. At the same time, this study questions how technology is currently being implemented in today’s classroom and how this may inform our planning to accommodate future flexibility.

Observation Parameters

The research took place during fall term 2010-11. Most observed classrooms were 30-50 students with a flat floor arrangement. All had general education academic courses. None were dedicated to a specific subject or department. I was paired with willing instructors on a volunteer basis and observed their classrooms in use. I observed what tools students and instructors utilized and how a classroom’s architectural features supported or interfered with the teaching and learning goals of the course. Observations occurred at public four-
2. OBSERVATIONS

year flagship institutions, public four-year regional institutions, and a community college. I observed several active classrooms at each campus I visited. Students ranged from traditional 18-22 year olds, to 30's and 40's and older. Instructor experience varied, but most instructors had more than five years experience teaching at college level. Instructors ranged from full professors to adjunct faculty. In actual observed settings, most students appeared to be traditional age with an even mix of male and female. Most instructors appeared to have well-developed and tested lesson plans. Two courses were hybrid classes (partially online, partially face-to-face), none were strictly online. All courses at the observed four-year institutions used some type of learning management software (Blackboard, Moodle, Desire2Learn).

In addition to classroom observations, I conducted informal interviews with instructors and students. These interviews took place either as part of my pairing with an instructor before the classroom observations started or directly following classroom observations. On one occasion, I held an informal discussion with the student government representatives from EOU.

Observed Environments

Since the sampling size was inherently limited, the courses, instructors and environments were randomly selected. The only requirement was that the observed classrooms held undergraduate-level general education courses. The request was silent on matters such as instructional method (lecture, seminar, etc), classroom technology or modernization, instructor experience, or spatial quality of the room observed. Some instructor pairings were arranged through the Facilities Departments, while others were arranged through Administration with help from the Registrar. As a result, there was a wide variety of spaces, courses, and approaches observed.

- University of Oregon, School of Education HEDCO 220 (Kevin Alltucker PhD, FHS 330)
- University of Oregon, School of Architecture & Allied Arts, Lawrence Hall Student Hearth
- Southern Oregon University, Central 015 (Larry Shrewsbury, Math)
- Rogue Community College, HEC 216 (Rebecca Breiholz, Psychology)
- Eastern Oregon University, Inlow Hall 013 (Mike Pierce, BA 210)
- Eastern Oregon University, Hoke Hall ASEOU Student Government
- Eastern Oregon University, Ackerman 103 (Ryan Dearinger PhD, History 201)
- Eastern Oregon University, Zabel 107 (Rita McMahon, BA 220)
- Portland State University, Neuberger Hall 381 (Jennifer Loney, BA 205)
- Portland State University, School of Business 140 (Jill Mosteller PhD, MKT 363)
2. OBSERVATIONS

Observed Behavior

Methodology: Observations were organized into four basic categories: architectural characteristics, instructor actions, the role of technology, and student engagement. With each classroom observation, the room layout was recorded and basic features were noted including technological features, lighting, daylight and control, floor and ceiling characteristics, finishes and furnishings, teacher location, and student seating arrangements. Observations also noted the apparent level of student-instructor interaction during the class period, general acoustics, the method or style of teaching, the use and type of electronic media if any, and the use and type of non-electronic media used, if any.

Observed Architectural Characteristics

Room Size and Proportion: All observed classrooms were rectangular rooms. Most had windows on one wall. Rooms that were proportionately approximately 1.5:1 seemed to be the most comfortable overall. Rooms that tended toward 2:1 or greater proportionally were less comfortable in general. In these rooms, the distance between the student and instructor seemed either too close or too far. Interestingly, the actual distance did not seem to be as important as the relative distance between instructor and student compared to overall room size.

One of the overall best performing rooms observed was at University of Oregon School of Education (HEDCO 220). This room was roughly 40’x60’ and designed to hold 108 students. I observed 84 students in the class. Students were arranged around pairs of trapezoidal tables in groups of 4-6. Despite the large size of the classroom, the room itself did not feel imposing. The ceiling was vaulted with a hipped gable. In the center of the room there was a controllable skylight and there were windows on two sides. Windows were controlled with opaque shades that were electronically controlled. The instructor used a microphone. Despite the large size, the students in the room seemed very engaged. Sight lines to the instructor and primary teaching media were excellent. No space felt particularly crowded or distant.

By contrast, one of the least comfortable rooms observed was at Eastern Oregon University (Zabel 107). The room was an irregular shape, but roughly 20’x40’. There were no windows in the room. Tables were arranged in three very long rows with the instructor’s podium located in the center of the front row. Students in the front row appeared to be uncomfortably close to the instructor while those in the back appeared removed and somewhat disengaged. Although the back row “felt” a very long distance from the instructor, it was actually no more than twenty feet. The acoustics in the room were also quite poor despite the relatively small size of the room. There was a noticeable noise created by the HVAC system and the relative distance of the instructor to the students made finding the right speaking volume difficult. Instructor volume appeared to be either too loud or too quiet.

Windows: With the exception of two observed classrooms at EOU, all classrooms provided exterior windows. Only a few provided interior or relieving windows to the adjacent corridor. Most classrooms observed had one bank of exterior windows, generally in the longer wall of the room. Some classrooms had ribbon or continuous windows, others had punched windows. The amount of glazing did
not seem to have as much effect on the room's performance as the control and placement of daylight. Rooms characterized as comfortable and having a high level of student-instructor engagement often had windows behind the students, facing the instructor. While this caused some glare problems for the instructor (as in HEDCO 220) it allowed for excellent visibility by the student. Another example of this arrangement, EOU Ackerman 103, appeared to have a similarly high degree of student-instructor engagement. The room was approximately 18’x30’. It had punched windows along the wall opposite the teaching wall. The windows were covered with metal horizontal blinds, manually controlled. The room faced west, but the class was observed in the morning so low sun angle glare was not an issue. Students and the instructor noted that afternoon classes are not as comfortable as morning classes in this room.

Some observed classrooms had operable windows. Where operable windows were provided and where exterior noise was not an issue, they were observed to be open during the class period. Most students said that they felt more comfortable in rooms with operable windows, however where exterior noise was an issue, operable windows were considered distracting.

**Daylight Control.** All classes observed used some type of large format overhead projection during the observed class period. Daylight control was achieved in a number of ways and with varying degrees of success. Control systems included perforated shade cloth, horizontal blinds, vertical blinds, opaque roller shades and fabric draperies. Most observed systems were manually controlled. However, in all cases, the position of the manually controlled shade devices was not changed during the observed class period. The only shade control devices that were observed to be changed during the observed class period were the electrically controlled units observed in HEDCO 220. Of the types of shade controls observed, perforated shades offered the best daylight harvesting but the least amount of daylight reduction or control. The majority of observed rooms use an opaque roller shade. Opaque shading, either draperies or opaque roller shades, appeared to offer the greatest compromise between daylight, views and darkness. The best application was observed in UO HEDCO 220, where the opaque roller was electronically controlled with pre-set stops at open, 1/3, 2/3 and closed. This allowed the instructor to provide daylight and views even during projector use, while offering enough light control to provide good illumination of the room. Motorized shade controls allowed the instructor to easily change the setting of the shades from his podium.

A few classrooms had exterior shading devices, and one classroom had interior light shelves. The shading devices appeared to be generally effective at controlling direct sun in the classroom during the observed class period. While the observed light shelves effectively created a uniform light level using only daylight, they created an illuminated ceiling condition that negatively affected the screen image. Based on observations, light control was observed to be the most desired quality. That said, rooms without windows were considerably less comfortable than rooms with windows.

**Ceilings:** Most classrooms had flat ceilings, although classrooms with shaped ceilings were also observed. Shaped ceilings typically included a soffit, generally over the teaching area as in Ackerman 103 and PSU School of Business 140.
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The shaped ceiling appeared to give prominence to the teaching area and focus to the student area. Large rooms with shaped ceilings also appeared to provide somewhat better acoustics than large rooms with flat ceilings.

Ceiling height varied by room. The relatively large HEDCO 220 was very comfortable with a tall vaulted ceiling that appeared to exceed 20’ at the peak. The rather small SOU Central 015 had a very low ceiling at 7’-6”, yet it was surprisingly comfortable during the observed two hour class period. Most classrooms were observed to have a 10’-12’ high ceiling.

**Noise and Acoustics:** Most classrooms had relatively good acoustics that allowed the majority of instructors to teach without a microphone. However, it was often difficult to hear or understand when students spoke from their seated position. While carpeted floor material was observed to reduce echo in the observed rooms, a substantial difference in the overall acoustics of the room was not observed based on floor finishes. Lower ceilings seemed to result in better overall acoustical clarity for speech, however they limited sightlines and felt cramped in rooms where the instructor relied heavily on projected media.

According to students, acoustical noise was a big concern. Issues focused on preventing outside noise from interfering with the classroom much more than problems with unclear speech or HVAC noise. The primary compliant was from noise outside the room in the form of noise from an adjacent classroom or noise generated outside the building. Interestingly, several students also commented on distraction caused by visual “noise” outside the classroom. Several students said that they had experience with distractions caused by people walking or vehicles moving next to ground floor windows.

**Air Distribution:** Heating, cooling and ventilation was generally provided by overhead, forced-air systems. One classroom had a sophisticated low return ventilation system (RCC HEC 216) which supplied conditioned air from the ceiling and returned it via low-mounted, through-wall ventilation. A few rooms had water or steam based heat from a radiator unit. All rooms appeared to have both heating and cooling. When the heating and cooling worked well (meaning good temperature, air flow, ventilation, low noise) students and instructors did not offer an opinion about it. On the other hand, when it did not work well, it was top of mind. Issues that were brought forward by users included noise, poor air movement, too much air movement, and excessive heat. When students and instructors were questioned about the HVAC, rooms with good performance received neutral responses and rooms with poor performance received very critical reviews.

**Lighting:** Many classrooms had only one kind of lighting, typically ceiling mounted ambient lighting. However, the most comfortable classrooms generally offered two or three kinds of lighting allowing highlighting for the teaching wall and/or perimeter walls as well as intermediate controls in the field. Some of the more recently constructed rooms had suspended direct or direct/indirect fluorescent fixtures. It is notable that the observed suspended indirect or direct/indirect lights were found to be distracting in some circumstances. The fully illuminated classroom ceilings were sometimes observed to create an uncomfortable glare and shadow when looking up at a projector screen. Additionally, the lights were
somewhat restrictive in terms of placement and variability of the ceiling-mounted projector. Most observed classrooms were illuminated with 2x4 recessed troffers with standard acrylic lenses for general ambient lighting. The very utilitarian and unremarkable lighting system was observed to be nonetheless effective in the Observed Classrooms.

**Finish Material and Color:** All classrooms except one (PSU SBA 140) had typical lay-in acoustic tile ceilings. All but two rooms had carpet flooring (SOU Central 015 and PSU NH 381). Observed students and instructors generally said they preferred the carpet flooring because it was quieter, more comfortable to stand on, and seemed "less institutional". Both carpet tile and broadloom carpet was observed. Rooms with flooring other than carpet used VCT. All rooms used rubber base, except PSU SBA 140 which had wood base to match the panel accents.

Most classrooms had four white walls. One room observed had accent paint on one wall (HEC 216). Another had wood paneling at several accent locations (PSU SBA 140). However, the most well-liked classrooms according to students had walls painted with a color other than white. Most younger students said that they wanted additional use of brighter or more lively colors on campus in general, including in the classroom. Older students said they prefer a more neutral palette. All students said that they preferred colored walls over white walls. Both HEDCO 220 and Ackerman 103 used a yellow wall color that students said that they were fond of.

**Furniture:** Most classrooms used a moveable table and chair arrangement. The most common table was a 18" or 20" wide x 60" long two person table. The widest observed tables were approximately 24" deep. One room had built-in furniture, one room had tablet arm chairs, one room had hexagonal sectional tables. A few classrooms had tables on casters, but most used a fixed leg system. Casters were often not locked in place and students complained that they moved too easily.

The most important furniture element, perhaps one of the most important elements in the room, was the chair. Many different types of chairs were observed including adjustable office-type chairs, tablet arm chairs, stackable chairs, padded and non-padded. According to observed behavior and student feedback, chair comfort was a determining factor in student engagement. Students said that padded chairs were critical for classes that were longer than one hour. A flexible or adjustable back also helped. Observed furniture included chairs with casters, fixed legs and sled style. The sled appeared to offer the most flexibility and comfort. Casters moved too easily, fixed legs were too difficult to move. Sleds allowed a chair to be light enough to easily relocate, yet stable enough to stay put.

Furniture spacing also appeared to be very important. The most engaged classrooms provided a "critical density" that was not unlike a successful restaurant. Students appeared to be most engaged in classrooms where they were relatively close to other students physically, but far enough away to allow circulation and interim breakouts to occur easily. Conversely, the most engaged classrooms offered a relatively large open teaching area to facilitate student-instructor engagement more effectively.
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**Area per student:** Most classrooms were relatively full, but not at capacity. Students generally were provided with about 11-15 SF of space including their desk, chair and personal space, but excluding circulation and the teaching area. A relatively compact student area (about 20 SF) seemed to be best for encouraging peer-to-peer and student-instructor engagement. However, these rooms also provided a relatively generous circulation area (about 35-45%) to allow easy movement. All classrooms observed had tables arranged in rows, with the exception of HEDCO 220 which had hexagonal tables evenly dispersed throughout the classroom space.

**Area per Instructor:** Most classrooms observed included a "smart" podium in the corner of the room opposite the classroom door. Many included a large table at the center of the "teaching position" which was used for papers, books, etc. This appeared to be a very useful element for the instructors that were supplied with this feature. The teaching space varied from small areas of approximately 60 SF to very generous spaces of about 250 SF or more. The most effective rooms offered an area about 8-10 feet wide for the full width of the classroom. This allowed the instructor to move around and easily engage students in question/answer dialogue. Additionally, this placed students in the front row far enough from the projection screen to allow comfortable viewing.

**Pre-function Area Outside Classroom:** Most of the observed classrooms had students waiting nearby prior to the start of class. About half of the spaces had seating and waiting areas built into the facility to accommodate this. These consisted of built-in benches, movable tables and chair and/or soft seating. Where facilities did not provide waiting areas nearby, students waited on the floor. This often caused crowding problems near the door area to the classroom. Additionally, student behavior in facilities without seating appeared less engaged than facilities where pre-function seating was provided.

**Observed Use of Technological Features**

**Lighting control:** Several classrooms included a "smart" podium that offered interactive digital controls for lighting and a number of other variable media control features. Many of the observed instructors said that they felt the podium controls were clumsy and they admitted that they were not confident using them. As a result, they were often ignored by the instructor. One exception was Dr. Kevin Alltucker, who demonstrated a mastery of the system provided in UO HEDCO 220. Dr. Alltucker was able to use the media and lighting controls to full capacity during the observed two hour class period. In his case, the room's features clearly enhanced Dr. Alltucker's highly varied and engaging teaching style. He said that he seeks opportunities to use classrooms like HEDCO 220 because they are more engaging for his students. Nevertheless, Dr. Alltucker was the exception rather than the rule. Most observed instructors did not alter the lighting or use other technological room enhancements available in the smart podium during the observed class period. When room lighting was adjusted in one observed case, the instructor asked a student to turn off the switches that were placed near the classroom door rather instead of using the controls located in the teaching podium.
Technology and Media: Every observed instructor used some type of overhead projection during his or her course. These varied from video to acetate transparencies, with all observed instructors using a PowerPoint slide show at some point during the observed class period. Many also used document camera projector systems (Elmo or similar devices). Slideshows and other projected media were most often run from the instructor's personal laptop computer, although a few instructors brought flash drives that were plugged into classroom's podium computer. Video and other sources were often accessed through YouTube via wireless internet access. Some instructors used standard lesson plans that accompanied a class text book. One instructor used acetate transparencies and an optical overhead projector.

Several classrooms were outfitted with large format LCD or plasma screen monitors, either to augment a central projector screen or in place of one. In the largest classroom, HEDCO 220, these provided enhanced visibility for students and were used to augment the large format central screen. However, observed students did not appear to use the monitors. Instead, they focused on the front of the classroom, either watching the instructor or the main screen. In follow up interviews, they said that they do not tend to use the monitors that are placed away from the instructor's teaching area and that they preferred to engage directly with the instructor as much as possible.

A number of smaller classrooms used large format LCD screen monitors instead of projector screens as their primary projection media, including a several observed classrooms at EOU. However, students and instructors uniformly said that they preferred a single standard projector screen. Both students and instructors said that the smaller size of the monitor screen did not outweigh its superior clarity and brightness.

Many observed instructors complained about poor sightlines to the screen from the teaching position. Often rooms were configured in a way that did not allow the instructor to see the screen while teaching. This meant the instructor had to rely on their laptop monitor only. Instructors said that they prefer to see both screen and monitor in order to better engage with students.

A few classrooms were equipped with microphones and overhead speakers, although only instructors in the larger classrooms utilized this. Most observed instructors said that they prefer to speak without a microphone provided the acoustics of the room supported that behavior. Additionally, two instructors played music as students arrived to class and at breaks. Music was played through their laptop and plugged into the room AV system.

None of the classrooms observed had an interactive whiteboard installed (such as SMARTboard). Traditional age students observed said that that most of their high school classrooms had this type of device and that it had worked well. Some observed instructors said that the technology would be useful, but most were content using a camera projector instead and posting images on a learning management software program if needed. Lack fo this technology did not appear to have a negative affect on student engagement.
All observed classrooms had whiteboards. Two classrooms also provided chalkboards. Whiteboards were generally preferred. Nevertheless, instructors tended to use whiteboards only to augment their teaching rather than as a central media, even in the observed math course. Instructors tended to rely more heavily on the digital camera projector and the PowerPoint slideshow. Often, the projector screen partially obscured the white board or chalkboard, which may have been a factor in their choice to use the projector media. However, this was observed to be acceptable where sufficient whiteboard was available to the side of the screen.

**Observed Instructor Behavior**

**Classroom Adjustments:** As noted previously, very few instructors modified the room in any way to accommodate their coursework and presentation requirements. Where the instructor arrived in a room with blinds drawn, they stayed drawn for the entire class period. Likewise if the shading devices were open upon arrival they remained open. This was also true for overhead lighting, accent lighting and table arrangement. When asked about it, the observed instructors said that moving furniture was too disruptive and time consuming. Furthermore, they complained that the automated systems were too complicated. As noted earlier, the sole exception was Dr. Alltucker, who took advantage of the wide customization available to his room HEDCO 220.

**Interaction with built-in technology:** Most observed classrooms had a "smart" podium, often with touch-screen controls and sophisticated A/V systems. However, most instructors (including Dr. Alltucker) brought their own laptop to drive their course presentations. The room's amplified speakers were often used, especially with video or YouTube clips which were accessed via the campus wireless network. Several instructors used embedded links to information or websites in their presentations. Instructors were not observed to use Google or similar search engines to augment their discussions.

**Multiple Teaching Areas:** The observed instructors reported that they rarely re-arrange the student tables and never change the location of the teaching wall. Most said that re-arranging furniture takes too long and changing the teaching wall location would be impossible since the projector does not move (all observed instructors relied on the projector for at least part of their observed classroom instruction). A few instructors said that they would change the teaching wall if relocating the projector was easy. There was no agreement about the best location for a teaching area. Some instructors liked the students spread out in the long wall to minimize distance to the back of the class, while others preferred students arranged in the short wall to minimize the need to move side to side.

**Method of Instruction:** As noted earlier, teaching methodology was not controlled during the request for classroom observation. Therefore, it is interesting to note that all observed instructors used a lecture format for at least part of their course. Most incorporated a question/answer dialogue technique with the students and about half of the instructors incorporated a small group or team break out component during the observed class period.
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Observed Student Behavior

Seating Arrangements: Students were generally observed to sit near other students and generally did not create large gaps between groups. Students did not appear to show preference for the front row or the back row of the class, but distributed themselves relatively evenly. The hexagonal or trapezoidal tables appeared to offer an advantage in that they created a semi-circle that enhanced small group interaction. However, students said that they prefer a straight table because someone is inevitably turned away from the screen during lecture or presentation discussions at a hexagonal table.

Small Group Breakouts: Many of the courses included a small group break out session during the observed class period. Of the small groups observed, about half were random organizations developed ad hoc to discuss an idea or theme. The other half were generally established teams working collaboratively on group projects. In one observed classroom (EOU Inlow 013) the instructor encouraged one of the small group teams to work in an area of the corridor adjacent to the classroom, while the other stayed in the classroom. The breakout that occurred away from the formal classroom was observed to be more engaged and effective than the group that stayed in the classroom.

Most small groups observed occurred in ad hoc groups distributed around tables within the classroom area. Where classrooms had hexagonal tables or straight tables in short rows (4-6 students per row) transition to the breakout groups occurred smoothly. Transitions were timed. Students were able to form small groups in approximately 30 seconds with this type of arrangement (EOU Ackerman 103). Furthermore, they appeared to intuitively form U-shaped groups around the ends of tables that facilitated good engagement and discussion that was maintained for the entire discussion period (15 minutes). However, where rooms were arranged in long rows of tables (8-12 students or more per row) the transition was less successful. The small group formation in one such room (EOU Zabel 107) took approximately 3 minutes to achieve. Due to the table arrangement, it was not possible to make U-shaped or semi-circular configurations. The observed small groups from this arrangement were not well-engaged and dissolved in about 5 minutes.

Use of Laptops and other mobile devices: Several students were observed with laptop computers in use prior to class. However, upon start of class, the majority of these students shut them down. Fewer than 10% of the students in any of the observed classrooms used laptops during class time. Only one student was observed with a laptop that was plugged into an outlet, those that did use laptops did so on battery power. Most of the observed students reported that they possess laptops, but they do not generally bring them to class because they are too heavy and cumbersome. However, with the advent of iPads and similar devices this may change over time. Further, many of the instructors reported to have mild prohibitions against the use of laptops during class. The overwhelming majority of students said that they prefer to take notes manually rather than on a computer. Several said that they can write faster than type and that writing helps them retain the information more effectively. Many younger students
today are taught keyboarding in elementary school so this may also change over time. According to the students observed, none had ever used a hard-wired data connection in a classroom or in the adjacent informal learning areas on campus. According to these students, wireless is ubiquitous and hardwired connections are not necessary.

Most students observed had cell phone or other mobile device with them. Many of these devices appeared to be smart phones capable of accessing the internet, texting, or sending email (Blackberry, iPhone, etc). Very few used these devices during class. Web-browsing by a few students was observed, but it was unusual during class. Web browsing was generally only associated with classrooms where students were observed to be otherwise disengaged.

**Food, Drink and Personal Items:** Food and beverages were not discouraged or prohibited in any of the classrooms that I observed. Several students brought coffee or water to class, especially in the morning. Very few ate food during class. Many students arrived at class with a backpack that was stowed under their chair, even when desk space was available.

**Is the physical classroom still relevant?**

According to “The College of 2020: Students” (Chronicle Research Services, June 2009) the extent of digital and virtual learning will dramatically change over the next ten years. While today the typical student of a non-profit institution takes few courses strictly online, the overwhelming majority of campus administrators feel that as many as two-thirds of students will use online learning as a primary method of coursework in the next ten years according to the report. Yet this did not match the expressed opinion of the students observed during this research. While all observed students reported that they have had at least some experience with online learning (webinars, hybrid courses, online/distance courses, or LMS programs like Blackboard) very few stated a preference for online learning when both options were available. According to the observed students who reported experience with online or hybrid courses, online courses were chosen for one of three reasons.

- **It was the only available option.** With increased enrollment and limited classroom and instructor time available, many of the institutions are relying on hybrid and online models to improve access to classes and improve classroom utilization per course offered. These courses generally have an associated extra cost to the student in the form of a fee. Some of the colleges and universities I observed are promoting the creation of virtual or hybrid courses internally by providing additional compensation for instructors willing to develop online courses.

- **To maximize time effectiveness for the student.** As noted previously, older students are becoming a larger part of the student body. Many have families or jobs that make traditional on-campus coursework more difficult. Online learning is seen as an attractive alternative that allows students to increase their efficiency and productivity during the day.
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- **As an alternate for introductory level lecture courses.** Many students feel that large, lecture style courses are inherently impersonal. For them, the online environment is roughly equivalent—sometimes even superior—to face to face. Online lectures offer the ability to pause, rewind, or search the web for related content in a way that can allow better retention and more engaged participation than traditional face-to-face lecture environments.

Given the option of time, cost and availability almost all of the observed students said that they would prefer a face-to-face learning environment over an online learning environment. Observed students commented that they believe that face-to-face learning is generally more effective, that online courses lack the rigor of face-to-face environments and that online courses are generally easier to pass. Observed students generally said that they believe that face-to-face courses are superior to online courses for all types of courses except large lecture style courses.
Essential Classroom Elements to Encourage Student and Instructor Engagement

Based on the observations of this study, several conclusions can be drawn regarding the essential design principles, features and characteristics of classroom environments that fosters engaged teaching and learning activities. The observed classrooms span a broad array of student demographics, instructor experience and campus settings. Yet there were surprising similarities between the general teaching and learning styles observed. The design principles outlined below characterize the essential or minimum architectural and technological features that were found in the classroom where students and instructors appeared to be most comfortable and engaged.

Room Size & Shape:
- Provide plan dimensional proportions of approximately 1.5: 1
- Avoid rooms with long, narrow proportions
- Avoid rooms with low ceilings
- Avoid rooms with no windows
- Avoid rooms with columns or other obstructions

Ceiling Height & Shape:
- Provide shaped ceilings or soffit areas where possible to focus attention on teaching area
- Provide minimum ceiling height of 10’-12’
- Avoid suspended light fixtures unless the ceiling is very high
- Avoid over-illuminating the ceiling or creating a shadow under the light fixture itself

Daylight & Views:
- Provide windows with a view to the exterior
- Control daylight and views with opaque shades
- Provide motorized shades with simple control from the teaching area
- Provide exterior shading systems for east, south and west facing windows
- Provide operable windows where the exterior environment is not disruptive

Finishes:
- Provide carpet or carpet tile flooring
- Provide colored walls
- Provide durable, low maintenance finishes
- Avoid white walls unless used with accent color
- Avoid hard, sterile surfaces and "timeless" color palettes
- Plan for room upgrades every ten years or less to keep the room "fresh"

Acoustical Control:
- Provide insulated walls that extend to structure and are acoustically sealed
- Provide low-pressure air systems when forced air is used
- Provide amplification for media and speech, but tune the room acoustics so the room's performance is not dependent upon enhanced audio
- Design the room so students can easily hear the instructor, but consider how students will hear each other as well
- Control for both interior and exterior noise
• Avoid operational windows in urban or other environments with exterior noise
• Avoid uninsulated walls, walls that do not extend to structure
• Avoid movable walls
• Avoid resilient floors
• Avoid hard ceilings

Furniture & Adjustability:
• Provide 18"x60" straight or trapezoidal shaped tables
• Provide chairs that move easily, but are steady when in use
• Chairs with sled-style supports are recommended
• Position tables allow small groups to form around them, but be close enough to allow a "critical density" of students to create engaged lectures and discussions
• Assume that tables will not be regularly moved but that lecture format courses will have to transform into small groups easily and vice versa–arrange table to allow both uses easily
• Avoid round tables unless lecture style presentations are unlikely to ever occur in the space
• Avoid tablet arm desks
• Avoid room layouts that assume a high level of user-directed changeability unless curriculum and pedagogy specifically call for that and class time is allocated to furniture movement

Connectivity:
• Provide robust wireless connectivity
• Avoid unnecessary costs of added hard wire data ports in classrooms

Lighting:
• Provide an easily controlled variety of lighting, including general lighting, perimeter accent lighting, and instructor area highlighting
• Provide dimmable or stepped lighting
• Provide override control for room occupancy sensor
• Avoid suspended lighting
• Avoid glare from exposed light sources or very bright reflectors

Controls:
• Provide simple, intuitive controls that require no special knowledge to operate
• Use simple switches where possible
• Provide labeled switches
• Place light controls near the primary teaching area
• Limit the number of switches to about 3-6 switches
• Avoid complex lighting controls

Student Arrangement & Area Requirements:
• Provide 30"x18" desk with 42" chair space (12.5 SF/student)
• Provide 8’-10’ x 16’-24’ Instructor area (128-240 SF, average 180 SF)
• Provide 40% internal circulation area
• Program space allocations based on the number of students, recommended instructor area and internal circulation based on observations
### Electrical Supply for Student Use:
- Provide perimeter plugs evenly distributed around the classroom to allow use for those who need power
- Avoid column drop outlets
- Avoid hardwired data connections for student use
- Avoid floor plugs except in computer lab spaces

### Instructor Arrangement & Area Requirements:
- Provide a generous teaching area (on average about 180 SF)
- Provide movable/adjustable instructor podium
- Position podium to provide good visibility of both students and the screen
- Assume that instructor will generally teach from one location regardless of teaching format

Plan instructor area to have direct connection to the door of the room allowing the instructor to arrive late or leave early if necessary

### Technology & Media:
- Provide large format projector screen and high quality ceiling mounted projector unit
- Provide amplified speakers connected to projection system
- Provide microphone for capability of amplified speech
- Provide instructor podium with
  - connection for instructor laptop
  - desktop mounted power supply
  - easy access to lighting and daylight controls
  - access to writing surface
  - document camera projector (Elmo or similar)
  - under-desk storage for backpack
  - stool stored under knee space (to allow standing presentations for most of the time)
- Provide 32 SF minimum (4’x8’) of whiteboard near the instructor podium
- Provide additional whiteboard around the room for small group break out and teaming activities
- Provide a robust, high-speed wireless system
- Assume that all technology is temporary and will be replaced in less than 10 years
- Assume that instructor will use personal laptop for media presentation
- Avoid hard-wired, built-in systems that are difficult to change out in the future
- Avoid the expense of built-in computer systems in the podium, complex lighting controls, podium storage areas, DVD players and other AV that is usually provided with the instructor’s personal laptop
- Avoid covering the whiteboard with the projector screen unless sufficient whiteboard is available when the screen is down
- Use surface mounted or easily accessed wiring systems where possible

### Prototype for the Essential Classroom
Based on the observed classrooms and resulting design principles, this prototypical classroom was developed to illustrate the essential features of a classroom that fosters student and instructor engagement. This is not intended to be a “prefect” classroom for all situations, but rather a model to be customized to the needs, goals and characteristics of each campus setting.
3. ESSENTIAL ELEMENTS

Use sled base chairs and movable tables to allow for flexible use of space.

Provide lightweight, stable tables but assume table configuration will not change regularly.

Provide white board wall. Avoid covering with screen or use full wall white board as shown here.

Provide color and interest on walls.

Provide visibility into classroom from hallway.

Provide a shaped ceiling to create a sense of enclosure, maximize sight lines to screen, and improve acoustics.

Provide wall mounted light switches and motorized screen and shade controls for easy access from podium.

Provide integrated, quality sound system with even distribution to maximize student comprehension.
3. ESSENTIAL ELEMENTS

WHAT MAKES A GOOD CLASSROOM?

- Provide comfortable seating for waiting and to encourage small group informal learning.
- Provide a variety of seating types to accommodate both groups and individuals.
- Provide adjustable instructors podium with pivot point.

1.5x

1x

- Provide team break out white boards.
- Stackable sled based padded chairs.
- Easily movable 18x60 tables for alternate small group configurations.
- Provide generous instruction area.
Booth seating provides opportunity for ad hoc small groups and informal learning.

Create inviting area outside classroom.

Provide soft seating and comfortable areas for small groups.
What Makes a Good Classroom?

3. Essential Elements

- Provide evenly spaced wall outlets near student seating area. Avoid cost of data jack at student areas by providing robust wireless connection.
- Provide clock-locate for easy visibility from students and instructors perspective.
- Make mounting point adjustable and wiring accessible to allow for projector upgrades every 5-10 years.

- Provide ample space for instructor movement at the front of the classroom and throughout student seating areas.
- Provide desktop and simple podium with convenient 110 V outlet and hard wired data port for instructor.
Provide sun shades at east, west, and south sides.

Provide good air movement, but use low pressure system to prevent noise problems.

Provide recessed light fixtures designed to minimize glare. Avoid suspended fixtures.

Provide white boards for team break-out sessions.

Provide simple adjustable podium. Avoid complex built in computer systems. Assume instructor will use personal laptop.

Provide access to natural light and motorized opaque shades with control from instructor podium.

Provide operable windows where possible.
Conclusions

The predominant pedagogy of instructors observed during this study was found to be a hybrid of traditional instructor-led lecture format and peer-to-peer group format. It appeared to utilize the benefits of modern communication media without existing solely within that environment. While many instructors appear to have become more familiar and comfortable with media such as PowerPoint, most observed instructors do not appear to utilize other technological features in day-to-day instruction.

According to student preferences reported in this study, virtual and online learning is likely to augment, rather than replace, traditional face-to-face learning environments. Based on this observation, the general purpose, mid-sized classroom will continue to be an important element for most campus environments, but certain technological features and architectural characteristics were found to be essential to their effectiveness. Some students and instructors will continue to seek virtual learning formats or technologically enhanced, multi-media learning environments. The development of these will add to the overall diversity of the campus learning environment. However the future learning environment does not appear to be one or the other. It appears to be both.

Based on this study, most students and instructors were found to prefer simple solutions over complex ones. They do not want to sacrifice the ability to access information, or the time needed to develop a mastery of media. Successful technological enhancements appear to be those that require no special knowledge or training to operate. The pedagogical style of most observed instructors appears to require rooms that adapt to both group projects and lecture presentations within the same class period. Students and instructors appear to be reluctant to re-arrange furniture or make other significant room adjustments during class time. Room environments that were able to accommodate group and lecture format learning without adjustment of the furniture were found to be the most flexible and successful.

According to these findings, certain principles were considered essential for successful classroom environments. Classrooms should allow ease of use and multiple learning formats without the anticipation of physical modification during the class period. All classrooms should have windows with views to the exterior and shading devices to control the amount of daylight entering the room. Complex digital systems were not viewed to be well utilized in most classrooms observed in this study. However, all classrooms were found to require a minimum level of technological enhancement. The most important media component was found to be a projector and screen. Based on these observations, additional technological enhancements were not found to be commonly used day-to-day or found to be required by students or instructors to foster effective engagement.

Gregg Sanders is an associate with SERA Architects in Portland, Oregon where he leads the firm’s higher education group. He is an active member and contributor to the Society of College & University Planners (SCUP) as well as the author of several papers on higher education planning.