Teaching, Learning, and Classroom Design

Miranda Carney-Morris
Lewis & Clark College
0615 S.W. Palatine Hill Road
Portland, OR 97219
1-503-768-7220
mccm@lclark.edu

Trevor M. Murphy
Williams College
56 Hopkins Hall Drive
Williamstown, MA 01267
1-413-597-2231
tmurphy@williams.edu

ABSTRACT

Our schools have a variety of classroom environments from the large lecture halls, to teaching labs with a computer for every student, to rooms with movable flat tables set in a circle. Many of our classrooms are equipped with data projection and podiums. Faculty often have favorite classrooms and try to book those rooms for their classes every year. Classrooms might be assigned by class size, but there are other factors about classrooms that either match or clash with teaching styles of our faculty.

In this paper we intend to explore how the classroom environment affects teaching and learning, and how classrooms can be designed to facilitate engagement and active learning at Williams College and Lewis and Clark College. We will also discuss the challenges in pursuing the creation of flexible learning spaces.

General Terms

Design, Human Factors, Standardization.

Keywords

Classroom Design, Learning Spaces, Education.

1. INTRODUCTION

1.1 Institutional Contexts

Williams College is a private, residential, liberal arts college located in the northwestern corner of Massachusetts in the town of Williamstown. The college has 2,000 students and 300 faculty members. The Office for Information Technology at Williams College consists of four groups including Networks and Systems, Desktop Systems, Administrative Information Systems, and Instructional Technology. The Instructional Technology group provides faculty with pedagogically informed technology support.

Lewis & Clark (L&C) College is a small liberal arts college located approximately six miles outside of downtown Portland, Oregon. Our student body consists of close to 2000 undergraduates, 550 law students, and nearly 600 other graduate students primarily in education and counseling. Serving these students, we have 400 full and part-time faculty. The Information Technology Department is organized in eight functional units including Service Desk, Educational Technology, Project Management, Institutional Operations, Academic Operations, Information Security, Systems Infrastructure, and Information Systems. Educational Technology provides faculty with pedagogically informed technology support.

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1.2 Why Talk About Classroom Design?

Several reasons to rethink classroom design from the Journal of Learning Spaces include the growth of mobile computing that allow content creation and ubiquitous access to information, online based learning and online resources, the shift toward constructivist learning, and collaborative learning environments [4]. There is also growing evidence documenting the positive impact of active learning over traditional lecture on student performance, especially in STEM fields [6]. As schools look to create positive outcomes for students, there is growing interest in how we can revamp our learning spaces to be more student focused.

2. CURRENT ENVIRONMENT

2.1 Current Classroom Environments

2.1.1 Lewis & Clark College

Classrooms at each of the three schools at Lewis & Clark have been designed to suit teaching styles preferred by faculty.

2.1.1.1 Law School

Classrooms at the Law School are a mix of lecture style classrooms with tiered U-shaped layouts and smaller seminar rooms with a conference table. Tables in these rooms are fixed with flexible seating. This suits the preferred teaching style of most faculty which is lecture.

2.1.1.2 Graduate School of Education and Counseling

Most classrooms at the Graduate School have moveable tables and chairs. The default arrangement for classrooms is a hollowed square. There is a teaching computer lab with fixed tables for desktop workstations and movable chairs. Large classes and continuing education seminars are held in a room with movable circular tables and chairs. This suits the preferred teaching style of most faculty which focuses on discussion/group work.

2.1.1.3 College of Arts & Sciences (CAS)

The CAS, our undergraduate campus, has the greatest variety of classroom layouts from large auditoriums to smaller seminar rooms with chairs arranged around a central conference table. Teaching style differs depending on class size and discipline. Several professors also use multiple styles during each class.

Our largest lecture halls have auditorium style fixed seating with attached arm chair tablets. There are a handful of larger lecture style classrooms with U-shaped tiered fixed tables. Chairs in these rooms are movable.

Most classes are held in rooms designed to accommodate 20-40 students depending on table/chair configuration. Some of these rooms include movable tables and chairs, including four with

trapezoid shaped tables. The majority of these rooms contain tablet armchairs which can be easily reconfigured and moved between rooms.

There are six computer teaching labs. Five have fixed tables with workstations and movable chairs. Three of these labs are arranged with rows facing forward. Two have workstations arranged on the outer wall with a conference table in the center. One classroom has a fixed laptop cart and contains movable rectangle tables and chairs.

Science labs are managed by the individual departments. Older labs have fixed tables and lab stools. Recently remodeled labs include a mix of fixed tables, stools and centrally located movable rectangle tables and chairs that can support group work or individual work with laptop workstations.

2.1.2 Williams College

Williams College has a variety of classroom types:

Socratic classrooms have almost horse shoe shaped seating that is sometimes tiered with several rows to facilitate discussion. Students can all see each other. The faculty member tends to be at the focal point of the classroom. There are five of these classrooms.

Seminar classrooms have seating around a central table. Some of the larger seminar classrooms have tables arranged in a circle with seating on the outside. There are 35 seminar classrooms at Williams.

Meeting rooms are essentially small seminar classrooms. There are three schedulable meeting rooms. They seat about 12 total.

There are 24 lecture halls with varied configurations. Some have fixed seating while others have movable furniture. Some of the fixed seating rooms look more like a movie theater. Many rooms in the sciences have chairs at heavy lab desks. One room has easy chairs with wheels on them that can be moved around. Movable furniture rooms have light chairs and light tables equipped with wheels for easy reconfiguration.

There are eight computer teaching labs. These rooms tend to have fixed tables to support the computers and monitors, but rolling chairs.

There are science labs that are managed by the science departments. If they have seating, it tends to be lab stools. The layout is dictated by the lab equipment. Other labs are conducted outdoors.

Tutorial classes are popular at Williams. Tutorials are classes where there is usually one professor and two students. They meet in faculty offices or in small rooms, such as a department conference room, that are not on the fixed classroom schedule. A chalkboard and a few chairs is a typical setup. Generally, these classes will have one student presenting an argument paper followed by an in depth critique by the other student. The following week, the students switch roles. There are 60 to 70 tutorial classes offered each year.

2.2 Classroom Equipment

Classroom equipment tends toward a standard and predictable setup allowing faculty who are familiar with the equipment to teach in any technology equipped classroom. However, exceptions exist to serve special requirements such as dual projection setups to support art history classes, for example.

2.2.1 Williams College

Classrooms are typically equipped with a PC desktop, a Mac desktop, laptop connections, a CD/DVD/VHS player, an audio system, and a data projector. Some classrooms have slide projectors or document cameras. Most have data projection for displaying output from computers and mobile devices. A few rooms have dual projectors with two projection screens. The classrooms are operated using an Extron System7 controller. Every teaching station has instructions for using the Extron System7 controller as well as a phone number to call for support.

An effort has been made to keep the classroom systems as identical as possible so that faculty can feel comfortable using a classroom they have never visited before. Exceptions are rare, but might include music classrooms where a phonograph record player is part of the audio system.

2.2.2 Lewis & Clark College

Classrooms are equipped with a standard equipment A/V rack controlled by a Crestron touch screen. Instructions for using equipment are provided. Classrooms include a phone with a number to call for support. Most racks include a Macintosh computer with a Windows virtual machine, laptop connection for projection, USB connectors, and a Blu-ray player or CD/DVD/VCR. Rooms have an audio system, data projector for use with computers and mobile devices and screen. Document cameras are part of the standard configuration on the Graduate Campus and on the Law Campus most classrooms are equipped with a lecture capture system. There are a few rooms with specialized equipment such as SmartBoards, slide projectors, an Apple TV, or dedicated video conferencing systems.

2.3 Classroom Assignment Process

2.3.1 Lewis & Clark College

At Lewis & Clark, classrooms are assigned by the Registrar for each school. Faculty are encouraged to inform the registrar early of any special needs such as a video conferencing system. Faculty who teach back-to-back classes are almost always scheduled in the same room. Faculty requests for specific rooms are honored on a first come, first served basis and registrar staff who schedule rooms work directly with faculty to accommodate these requests. In some cases, IT will suggest modifications to take advantage of specialized equipment such as video conferencing systems designed to support classes that enroll remote learners.

A challenge we face in promoting flexible learning spaces is that most faculty will accept a room that is available at a convenient time and location even if the layout is not well suited to their teaching style.

3. HOW CLASSROOM ENVIROMENTS AFFECT TEACHING AND LEARNING

There are numerous research studies on classroom seating arrangements [7] and comparing Active Learning Classrooms to traditional classrooms at large institutions [10]. While studies can inform or suggest broad goals and opportunities, they cannot not address circumstances unique to your institution. They are also often conducted at large public universities which may have an environment and focus quite different from your institution – this is definitely the case for small liberal arts colleges. Collecting feedback from your faculty and students is often necessary to develop an understanding of how your campus classroom environments are impacting teaching and learning practices typical of your students and faculty.

At Lewis & Clark, we learned this lesson the hard way when we failed to account for classroom environment factors such as furniture/space constraints, classroom assignment practices, and infrastructure during early efforts to promote technology associated with active learning. In response, we stepped up our internal data collection efforts and started to discuss reviving the CAS classroom

committee which was disbanded at the conclusion of the last major building renovation on the CAS campus. In the summer of 2015, the committee was reconstituted by the Dean of the CAS and asked to provide oversight and review of the classrooms. The committee decided to expand membership to include those responsible for Graduate and Law School classrooms to allow for more coordinated data collection, sharing, planning and outreach.

Our charge for the 2015-2016 academic year was to research the following:

1. Do Lewis & Clark classrooms meet the needs of today's student? Are they configured, equipped and built to enhance the way students need to learn today vs. a decade ago? If not, what changes could be made? Aspects to consider included room configuration, environment, technology, impact on student learning outcomes and faculty interest in pedagogical approaches enhanced by reconfigured classrooms.
2. Review current task flows and renovations prioritizing to ensure that we are taking the best approach to maintaining our learning spaces.

The committee has spent much of the first year sharing and collecting data and discussing how to secure and make the best use of funds available for classroom renovations. To aid in this effort, the Associate Dean of CAS and Director of Administrative Services at the Graduate school sent the following email survey to their respective faculty:

1. Please describe strategies that would allow for greater faculty input in designing or improving teaching spaces.
2. What are your current obstacles in the classroom for group work?
3. How often do you reconfigure the classroom to match the lesson of the day, and how easy is it to do so?
4. Specific feedback on lecterns in Social Sciences building.
5. General comments
6. [Graduate School only] Please describe your teaching style. What classroom features, either present in our classrooms or not, would support you in your teaching style?

We received 33 individual responses. Much of what we had learned from feedback through other channels was confirmed, however, there were a few results that were surprising. Concerns raised included:

- Flexible chairs were seen as key. No one liked classrooms with fixed arm chair seating.
- Overcrowded classes/extra chairs. For example, smaller classrooms might be scheduled to only comfortably fit a lecture style tablet armchair layout. This is frustrating for faculty who prefer to arrange chairs in a circle or in small groups.
- Overcrowded rooms make it difficult or impossible for faculty to easily navigate the room to support group activity.
- Odd shaped rooms make it difficult to configure rooms in a discussion circle.
- Rooms with tables are favored by faculty teaching classes where students need table space for class materials.
- Rooms with trapezoid desks were universally disliked. The tables were described as heavy, hard to move and created a room difficult to safely navigate.
- Concerns about classroom projection screens which cover the whiteboard in the front of classrooms when in use. Concerns varied from wanting to project and use the whiteboard at the same time to just wanting additional whiteboards.
- Reliable network/Internet connectivity for BYOD devices (faculty laptop, mobile device, etc.) was a concern for some.
- Inability to project wirelessly forces most faculty to teach from the front of the room when they want to use the projector.
- Reliable video conferencing connectivity for distance education students.
- Tablet armchairs are not big enough for today's student who may have a laptop, notebook and a water bottle.

One important environmental issue raised through another channel was poor soundproofing in some of our buildings. We learned of this issue during a faculty development event focused on active learning. Faculty who are flipping and looking to incorporate group work mentioned receiving noise complaints from neighboring classrooms.

4. HOW TO DESIGN CLASSROOMS THAT FOSTER ENGAGEMENT AND ACTIVE LEARNING

EDUCAUSE has assembled some materials on the topic of classroom design. Malcolm Brown provides seven principles for classroom design [1]. These principles include designing with the campus context in mind, having an inclusive planning and design process, insuring adequate support for operations, environmental quality, layout and furnishings, tools and technology, and innovation. In addition, there is a spreadsheet for rating a learning space on these categories. Each area has sub-topics that can be judged. The section on layout and furnishings, for example, has 14 items to look for in a learning space. These topics include the expected items like seating density, writable surfaces, and physical storage. There are also items relating to furniture configuration options, movable partitions, movement through space, and access to adjacent informal learning areas. [3]

FLEXspace.org provides access to images and comments about innovative learning spaces [5]. The FLEX in FLEXspace stands for Flexible Learning Environments Exchange. The learning spaces are sorted into categories for browsing. Some of the categories are: informal learning, demonstration, critique, and small group learning. The collection could use more contributions of photos to broaden the resource, but the idea of sharing images of learning spaces is a good one.

Inspiration can also be found from universities that are pioneering research in Active Learning Classrooms. The University of Minnesota Center for Educational Innovation has an extensive website that includes floor plans and best practices [2]. NC State University's SCALE-UP website [8] is geared more towards larger universities, but still has several examples, pictures and a directory of universities that have established active learning classrooms.

5. LESSONS LEARNED / CHALLENGES

- At Lewis & Clark, projects that incorporate only one of these design principles fall short of our goals. For example, early attempts to promote active learning focused primarily on researching state-of-the-art technology and tools such as interactive touch screens, BYOD projection and video conferencing technology.

This tech-focused outreach met with limited success as it failed to take in account multiple other factors (context, environmental, and cultural) which limited faculty interest or even ability to use these technologies. While we did come up with a few transformative uses for technology, the overall impact on teaching and learning at the College of Arts & Sciences was lower than hoped.

- A centralized classroom planning committee can be invaluable in creating the broad campus support often necessary to secure funding for experimental renovations when resources are limited.
- Collecting and sharing data about classroom experience and attitudes from faculty and students can be invaluable in directing classroom renovation efforts and faculty development programming/outreach.
- Creating flexible learning spaces can be costly both in terms of renovation and equipment costs, but also because of lower room capacity.
- Creating opportunities for faculty to get hands-on experiences with flexible classrooms in a low stakes environment can be key in promoting greater adoption. This is a challenge for campuses that do not have the space or funds to permanently establish experiential classroom spaces. At Lewis & Clark, our classroom committee is looking for classroom spaces where we can do small scale innovations and faculty development and outreach events where we can provide hands-on experiences with furniture and technology that supports active learning.
- While scheduling staff come to know over time what rooms specific faculty prefer, it would be better if information about teaching style preferences was routinely collected and considered when scheduling rooms.
- Collecting data that demonstrates the impact on student learning beyond the preferences of faculty and students may be beyond the expertise of Information Technology and other staff supporting classrooms.

6. CONCLUSIONS

Classroom design has a quiet and often hidden impact on teaching and learning at a liberal arts college. Faculty are adept at adapting teaching methods to the constraints of a given space and may not know how or when to advocate for change, especially when room assignments change semester to semester. At Lewis & Clark and at Williams College the reestablishment of a classroom committee has helped with data collection. In addition, it has made the most of limited resources by coordinating efforts to identify opportunities and funding sources for flexible classroom renovations and promotes spaces that currently exist.

7. ACKNOWLEDGMENTS

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