Collaborative Learning Spaces Project (CLSP)

Classroom Redesign for Active Learning Pedagogies

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University of Arizona
Collaborative Learning Spaces Project (CLSP)

Executive Summary

The Collaborative Learning Spaces Project, an extension of the UA AAU Undergraduate STEM Education Project, is a university-wide collaborative effort at the University of Arizona to develop classroom environments that are more suitable for active learning pedagogies than traditional lecture halls. Active learning spaces are designed to engage learners in real-time problem solving through critical thinking, modelling and teamwork. The spaces are outfitted with collaboration tools such as furniture (e.g., round/mobile tables), writing surfaces, and technology. The first phase of the project was a fast-paced pilot to develop and test an active learning classroom. This pilot was conducted in the Science-Engineering Library's Journal Room (Rm 200S) which was transformed into a large, 260-seat collaborative classroom. During the month-long pilot, the space was used by eight University of Arizona classes to explore active learning spaces in order to better understand the technology, physical space requirements, and pedagogical needs for building effective collaborative learning environments at the UA. In addition, the space was used for many other purposes outside of regular class hours such as workshops and out-of-class collaborations. Based on the results of the pilot, two key recommendations were made: 1.) Establish a UA CLS Consortium dedicated to creating spaces across campus that facilitate collaborative learning, and 2.) Convert the Science-Engineering Library space into a permanent Collaborative Learning Space for large classes that incorporate collaborative and active learning pedagogies.

Introduction

Around the country, several research universities have developed classrooms specifically designed for collaborative learning that is student-centered. Faculty members teaching in these spaces have redesigned their instructional approaches to use active learning pedagogies that are based on evidence from the education literature that indicate these approaches result in enhanced student learning. Examples of such facilities included the SCALE-UP Project at North Carolina University, the Active Learning Classrooms at the University of the University of Minnesota and the Learning Studio at the University of Virginia. In addition, the UA College of Medicine in Phoenix and in Tucson have built or renovated existing space, respectively, for active learning.

Late in the summer of 2014, a faculty member from Chemistry and Biochemistry, John Pollard, approached Gail Burd because he was frustrated by his classroom. John uses active learning pedagogies that encourage student collaboration in his general chemistry course which enrolls as many as 260 students in a single class. John normally teaches in a traditional lecture hall with auditorium style seating. With his knowledge of all the wonderful facilities at other universities, John wanted to try teaching in an environment that more effectively facilitates collaborative learning. This led to an impromptu meeting between John Pollard, Gail Burd and Karen Williams, Dean of Libraries. As a result, the Collaborative Learning Spaces Project (CLSP) was launched.

A team of faculty, administrators and professionals from the library, UITS, and academic affairs came together to develop a collaborative learning space in the previous journal room in the Science-Engineering Library (SEL Rm 200S). Attachment 1 lists the project team members.   In less than three months' time, the stacks of journals were removed, technology was borrowed and installed from the library and UITS, and furniture was rented and borrowed to serve 260 students. Attachment 2 shows the Project Schedule for the Science-Engineering Library CLS room construction. Eight faculty members were identified to teach in the space for the month-long pilot. This list of classes/instructors for the SEL CLS pilot is shown in Attachment 3.

Peer Institutions

The UA Collaborative Learning Spaces Project (CLSP) strives to learn from peer institutions that have implemented collaborative learning spaces on their campuses. Below please find a description of some of the spaces that have been installed at other institutions:

North Carolina State University SCALE-UP (Student-Centered Activities for Large Enrollment Undergraduate Programs) Project
http://www.ncsu.edu/per/scaleup.html

The primary goal of the NCSU SCALE-UP Project is "to establish a highly collaborative, hands-on, computer-rich, interactive learning environment for large-enrollment courses". The benefits include:

- Ability to solve problems is improved
- Conceptual understanding is increased
- Attitudes are improved
- Failure rates are drastically reduced, especially for women and minorities
- "At risk" students do better in later engineering statics classes

University of Minnesota Active Learning Classrooms (ALCs)
http://www.classroom.umn.edu/projects/ALCOverview.html

The Science Teaching and Student Services Building at the University of Minnesota has ten Active Learning Classrooms.
The classrooms "are designed to foster interactive, flexible, student-centered learning experiences, and operate using central teaching stations and student-provided laptops".

A pilot study conducted found that "instructors and students overwhelmingly found that this space made a difference for them".

University of Virginia School of Medicine Learning Studio
http://www.medicine.virginia.edu/education/medical-students/admissions/the-uva-som/our-facilities/educational-facilities.html

The UV School of Medicine Learning Studio is a technology-enabled, active-learning (TEAL) classroom that was designed for the Next Generation curriculum. "This interactive learning environment uses the latest technology to engage students in active learning. This space incorporates the five modalities of adult learning. Five technologically sophisticated screens – each measuring 20 feet across - descend into the space and tie into each group table, so that students can share with a small group or the entire class."

<u>Stanford Design School (d.school)</u>
http://dschool.stanford.edu/our-point-of-view/

"Rather than classrooms, [Stanford]l has studios at the d.school. These are flexible spaces that can be manipulated in a variety of ways to create different environments. The tables and couches are on wheels, the chairs and stools are light-weight, and the whiteboards are either small enough to be picked up, on wheels or hooked to tracks in the ceiling." (http://dschool.stanford.edu/fellowships/ 2014/07/10/beyond-a-classroom-the-many-faces-of-a-d-school-studio/)

Science-Engineering Library Collaborative Learning Space (SEL CLS) Pilot, Fall 2014

<u>Overview</u>

The leadership team, specifically Gail Burd, Senior Vice Provost of Academic Affairs, and Karen Williams, Dean of Libraries, agreed to work collaboratively to create a temporary space for a CLS pilot. The space selected was the former Journal Room (Rm 200S) in the Science-Engineering Library. Equipment, furniture, supplies and facility upgrades for the CLS pilot were made possible through a collective effort of the UA Office of the Provost, Facilities Management, UITS and UA Libraries. Two short videos summarizing the pilot are available at: http://uanews.org/videos/classroom-innovator-paul-blowers and https://www.youtube.com/watch?v=aNCizPVnRkQ&rel=0.

Purchased or borrowed technology for the room included a fully-equipped instructor station, short throw projectors, wall-mounted and rolling cart-mounted monitors, speakers and cordless microphones. Much of this equipment (e.g. instructor station, projectors, monitors, etc.) is standard technology for UA centrally scheduled classrooms Classroom Technology Upgrade Program. UITS installed a sophisticated high-density wireless networking system to accommodate the significant increase in the number of concurrent users in the space. A variety of tables and chairs were rented for the pilot and items such as desktop whiteboards for each table and A-frame whiteboards on wheels, as well as other supplies, were borrowed or procured. Table I provides a summary of the costs for technology, networking, facilities, furniture rental and supplies for the pilot:

Table I: Summary of CLSP Pilot Costs

Area	Total:	Purchased:	Borrowed:	Labor:
Technology (instructor station, projectors, monitors, etc.)	$59,680	$12,250	$47,430	NA
Networking	$12,390	$6,110	NA	$6,280
Facilities	$3,470	NA	NA	$3,470
Furniture Rental	$3,860	$3,860	NA	NA
Supplies (whiteboards, etc.)	$6,510	$6,510	NA	NA
Total:	**$85,910**			

Eight STEM instructors and over 1,400 students participated in the pilot. Invaluable feedback was provided during and following the pilot.

<u>Evaluation</u>

Data for the pilot was gathered in the following ways:

– Student pre- and post-pilot surveys were administered to collect quantitative and qualitative data regarding students' perceptions of the traditional and CLS classrooms.

– Instructors' informal reflections during the first week of the pilot provided early feedback to the project team.

– Formal instructor debriefs were conducted during the pilot to obtain formative evaluation data.

– Instructor surveys and interviews were conducted post-pilot.

Attachment 4 provides the list of pre and post student survey questions. Attachment 5 contains selected results from the student surveys. Attachment 6 contains the slides from the SEL CLS Post Pilot Stakeholders' Session which highlight the feedback from the key stakeholders, specifically, the instructors.

It was apparent from the student survey data collected that in general the room enhanced student engagement and communication, both critical components to active learning pedagogy. It also seems that the students perceived the access to the instructor to be slightly diminished. We believe that in part this is due to the presence of the pillars (removing the line of sight to instructors for certain areas) and the fact that the room enhanced student collaboration more (a goal) which changed the central role of the instructor, even within the framework of an active learning approach. These are things that we are addressing with the redesign of the space, visualizations and supporting technology.

In general, faculty members who taught in the SEL CLS during the pilot felt the space was beneficial. They were encouraged by the level and quality of communication between the students, although they expressed some concerns about the increase in socializing that distracted students at times. They concurred with students regarding the challenges of the physical space such as line-of-sight issues caused by the pillars. In addition, all of the instructors recognized a need to modify their course materials and presentation strategies to take advantage of the space more fully and formulated plans for better preparing themselves and their students, TAs and preceptors for the space. Below find a sample of the instructor comments:

– "I love the idea of teaching in this kind of space…"

– "Good for problem solving activities."

– "The pillars are a fairly serious issue: getting attention of instructors/preceptors."

– "It has been a very educational experience about how space influences teaching."

– "My course needs more changes to take better advantage of the space."

– "Lack of central focus."

– "We need to continue the momentum that has been started."

The student and instructor feedback informed the recommendations described later in this report.

Collaborative Learning Spaces (CLS) Workshop

A Collaborative Learning Spaces Workshop was conducted on October 29-30, 2014. The objective of the workshop was to bring together those who share a common interest in improving student learning by providing learning spaces that facilitate student-student and student-faculty interactions. UA participants included faculty members, administrators, architects, library, UITS facilities and Disability Resource Center (DRC) staff, among others. Attachment 7 shows the agenda for the workshop. During Day 1, participants had the opportunity to observe a class in the Science-Engineering Library Collaborative Learning Space taught by Dr. Paul Blowers and listened to the insights of Dr. John Pollard, Director of Chemistry Education, and Gail Burd, Senior Vice Provost of Academic, who were instrumental in launching the CLSP. In addition, Jeanne Narum, Learning Spaces Collaboratory, and Andy Labov, CO Architecture, shared their insights about lessons learned at other institutions that have created collaborative learning spaces. Attachment 8 includes Andy Labov's slides. On Day 2, participants worked in small groups to develop creative design solutions for a variety of rooms at UA that may be candidates for redesign. The candidate spaces for redesign included in the workshop were:

- Science-Engineering Library CLS (55 ft x 113 ft)
- Beardown Gym (118 ft x 195 ft)
- BioSciences West Rm 301 (40 ft x 70 ft)
- Gittings Gym Rm (78 ft x 108 ft)

BioSciences West Rm 301

Beardown Gym
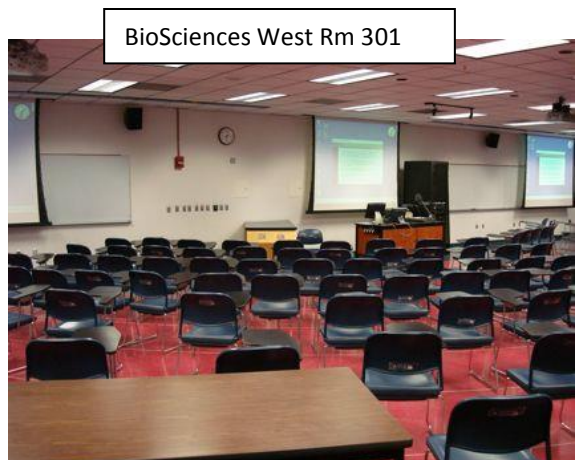
Science-Engineering Library CLS

Gittings Gym

The conceptual designs for these spaces which were developed during the workshop are included in Attachment 9. At the conclusion of the workshop, recommendations for next steps, as described in the following section, were discussed.

Recommendations

Based on the results of the Science-Engineering Library Collaborative Learning Spaces pilot and the discussions during the CLS workshop and other ongoing efforts, the following important recommendations were made:

1. Establish the UA Collaborative Learning Spaces (CLS) Consortium.

   The mission of this consortium is to expand the number of learning spaces on campus to support the growing effort of faculty to engage students in taking an active role in their learning through collaborative interactions that support critical thinking. We plan to expand in a technologically "forward thinking" fashion learning that is sustainable, accomodating, cost effective and above all designed for our students and faculty so that they have environments which support active learning, collaboration and intellectual exploration.

   In addition, it is planned to establish a community of faculty on campus who can meet, share ideas and assist each other in the scholarly endeavor of the implementation of active learning strategies in spaces that are designed to support these practices.

2. Convert the SEL CLS into a permanent collaborative learning space that can accommodate large classes.
   Many lessons were learned from the pilot project in the SEL CLS. Based on the feedback from the students, instructors, library staff and instructional technology team, it was concluded that we make this space the first permanent collaborative learning space for large classes on campus. The room has some limitations (the main one primarily being the concreted pillars), but the benefits of a permanent conversion for our students, instructors and campus as a whole far outweigh any challenges.

   Two categories of constructive feedback emerged from this work; one could be classified as challenges that could be addressed through instructional, spatial and technological adjustments and the second are challenges that emerge from aspects of the space that cannot be changed, namely the concrete pillars that are in the space.

   Specific recommendations for the permanent space are described below:
   - Furniture
     - Furnish the room with round folding tables on wheels that will accommodate six students and chairs on wheels that can be stacked or nested. Select a single size/style of table and chair to achieve an orderly appearance.
     - Round tables promote communication. However, communication at tables with more than six students can be hindered due to the distance between students seated across from one another.
     - Chairs with wheels allow students to rotate as needed to view monitors, instructors or white boards and to collaborate with students at other tables.
     - Folding/nesting furniture allows the library to use the space for other purposes when classes are not in session.
   - Classroom layout
     - Use a simple, uniform classroom layout to minimize confusion.
     - Ensure that the classroom staff has enough room to easily navigate around the room and that every seat has a good view of one or more monitor or screen.

- – Designate a central open area for the instructor to stand when giving explanations (i.e. short lectures). Place several cameras on the area so that the image can be projected to some or all of the monitors and screens throughout the room.

- Projectors, screens and monitors

  - – Increase the number of monitors and projectors to ensure that all students have a good view of the projected images/video.

  - – Ideally, mount a monitor on opposite sides of each pillar to reduce the impact of pillars on the students' line of sight.

- Power to tables

  - – Provide easily accessible power outlets to a minimum of 25% of the seats distributed throughout the classroom.

- Microphones/Class-wide Communication

  - – Provide additional portable microphones and a convenient strategy to store and access microphones during class.

  - – Install communication software that allows students to electronically communicate with the instructor and classroom staff. For example, students should be able to post questions when they arise.

- Facilities

  - – Route wires/cables for monitors and speakers, power outlets, etc. in a manner to minimize visual and physical impact. For example, cabling for projectors, speakers and monitors should be routed through the ceiling and, if possible, wiring for power to tables should be placed under the carpet tiles so that they don't impede traffic or movement of rolling tables and chairs.

- Classroom staff management

  - – Establish zones in the classroom so that each table has one (and only one) assigned preceptor or TA responsible to aid student learning.

  - – Provide brightly colored clothing (e.g. vests) to make classroom staff easy to identify.

  - – Provide training to classroom staff to ensure that they effectively promote collaborative learning. Classroom staff are responsible for encouraging students to stay on task. They also play an important role during the transition from one activity to the next (e.g. at-the-table collaborations to instructor-led explanations, etc.).

  - – In some classes, instructors may choose to assign students to specific tables or zones.

- CLS Workshop

  - – Create a workshop that prepares faculty members and other classroom staff for the CLS.

  - – The workshop will be divided into two parts:

    - ▪ Part I will focus on pedagogy for instructors and will be conducted well in advance of the semester.

    - ▪ Part II will focus on classroom management, instructional support strategies, communication, etc. for the team of instructors, TAs and preceptors.

A self-organizing project team has been convened to implement these recommendations. The team includes representatives from faculty, UITS, Library, Facilities, Office of Instruction and Assessment (OIA) and Disability Resource Center (DRC), among others.

Efforts are underway to determine the costs for the permanent buildout of the SEL CLS. The major cost categories are shown in Table II below:

Table II: Major Cost Categories for SEL CLS

Furniture
• Folding tables with power ports and wheels
• Nesting chairs with wheels
Technology
• Monitors, projectors, screens, cameras, microphones
• Application software, etc.
Facilities
• Power to tables (~25% coverage)
• Cabling/mounting through ceiling for speakers, monitors cameras, etc.
Supplies
• Tabletop and A-frame whiteboards, etc.
Support
• Design
• Teaching in the CLS Workshop

Conclusion

Overall, it is our view that the SEL CLS space is just the beginning and that the development of more of these space on campus will eventually lead to certain spaces playing a role as "better suited" for different aspects of active learning pedagogy. For example, the SEL CLS is extremely well-suited for TA-lead group based problem solving (a proven and effective instructional approach in STEM education) where the primary focus in on the students interacting and the TA just supports the work. For approaches that are student-centered but rely a bit more on a faculty leading the entire group, other spaces where line of sight is different and spatial arrangements accommodate this might be more appropriate. Currently on campus, the general classroom design is quite homogenous and limiting as result. The permanent build out of the SEL CLS will not only open up options for instructors engaging in active learning approaches but symbolizes a new era campus where there is a diversity of learning spaces meant to best accommodate student learning, critical thinking and the engaging instructional approaches that support these goals.

Attachment 1: Collaborative Learning Space Project (CLSP) Team

Leadership

Gail Burd, Senior Vice Provost for Academic Affairs

Karen Williams, Dean of Libraries

Nikolas Glazier Hodge, Director, Project & Services Success Office

UITS

Katy Holt

David Mayhew

Richard Brindamour

Paul Radek

Faculty

John Pollard

Paul Blowers

Library/Facilities

Rebecca Blakiston

Robyn Huff-Eibl

Hayri Yildirim

Office of Instruction and Assessment (OIA)/Multimedia Solutions

Gary Darnell

Veronica Rodriguez

Casey Ontiveros

Jane Hunter

Disability Resource Center

Dawn Hunziker

Diedre Lamb

Attachment 2: SEL CLS Project Schedule

Activity:	Week Ending:								
	3-Oct	10-Oct	17-Oct	24-Oct	31-Oct	7-Nov	14-Nov	21-Nov	28-Nov
Space and Technology:									
Evaluate furniture options	████◆								
Define functional requirements	████◆ Finalize functional requirements								
Identify videography needs	██████◆ Finalize videography plan								
Room available for CLSP	◆								
Room build (fac., furn., tech, AV)			████◆ Room build complete						
Technology testing				████ 10/23 - User accpetance					
CLS Workshop				◆ Finalize agenda	◆ 10/29-30 Workshop				
Teaching:									
Recruit instructors	███◆ Instructor Kickoff				◆ 10/23 - Faculty Forum	◆ Faculty Debriefs		◆	
Conduct pilot classes					████████████████████				
Research:									
Develop instruments/ IRB	██████◆ Submit student survey		◆ Submit faculty instruments						
Student consents/ surveys		███◆ Consents		◆ Pre-survey		███████		◆ Post-survey	
Conduct interviews/focus groups							██████████		

Attachment 3: SEL CLS Pilot – List of Classes

Course #:	Course Name:	Instructor:	Enrollment:
CHEE 201	Elements of Chemical Engineering I	Blowers	106
CHEM 151-002	General Chemistry I	Pollard	263
CHEM 151-010	General Chemistry I	Talanquer	254
ECE 175	Computer Programming for Engineering Applications	Thamvichai	225
MCB 181*	Introductory Biology I	Elfring	336
MCB 305	Cell and Developmental Biology	Nagy	168
PHYS 102	Introductory Physics I	Kirby	140
PHYS 141**	Introductory Mechanics	Milsom	182
* Class split – half in CLS ** Nov. 7th and Nov. 21st only			**1,674 (Total)**

Attachment 4: SEL CLS Pilot Student Survey Questions

Questions 1 thru 25 were included on the both the Pre and Post Survey:

1. A University of Arizona IRB approved study that focuses on undergraduate STEM education …
2. The classroom for this course promotes student participation in the learning experience.
3. The classroom for this course makes me want to attend class and to contribute during class.
4. The classroom for this course promotes discussion in class.
5. The classroom for this course enables me to communicate effectively with my classmates.
6. The classroom for this course allows me to interact with my instructor.
7. The classroom for this course makes me want to put forth effort to complete the learning activities.
8. The classroom for this course facilitates multiple types of learning activities.
9. The classroom for this course provides flexibility to learn the way I like to learn.
10. The classroom for this course makes it easy to share information.
11. Learning is enjoyable in the classroom for this course.
12. The classroom for this course facilitates the in-class exercises.
13. The classroom for this course is difficult to use and frustrating at times.
14. My instructor is effective in using the technology in the classroom for this course to enhance my learning.
15. My instructor is effective in using the classroom space to enhance my learning.
16. Are there problems with the classroom for this course such as poor lighting, sound quality, seating arrangements, that made it difficult for you to learn?
17. If you answered "Yes" to the previous question, please tell describe the problem(s):
18. Which types of technology did your instructor use in the classroom for this course ? (Select all that apply.)
19. Which types of technology did you use in the classroom for this course? (Select all that apply.)
20. Which tools such as clicker, notebook, pen, smartphone, laptop, paper or recording device did you bring into this room to help you learn?
21. How would you describe your ability to view the instructor's presentation materials in the classroom for this course?
22. How would you describe your ability to hear the instructor's presentation in the classroom for this course?
23. How would you describe your ability to hear your classmates during group work in the classroom for this course?
24. How would you describe your ability to alert the instructor, preceptor, or teaching assistant to your questions in the classroom for this course?
25. f you could change one thing about the classroom for this course, what would it be?

Questions 26 thru 31 were included on the Post Survey only:

26. The classroom in the Science Library allowed the instructor to make better use of the students' time in class.

27. I would take another course that was held in classroom in the Science Library.

28. I would rather have class in the regular classroom for this course than in the Science Library classroom.

29. In what ways did the physical set up of the classroom in the Science Library impact your learning during the last two weeks?

30. Describe one thing that you liked about the classroom in the Science Library?

31. Is there anything else you would like to share about your experiences over the last two weeks?

Attachment 5: SEL CLS Student Survey Results – Selected Questions
(Double-click image to open the PDF)

Collaborative Learning Space Project (CLSP)
Post Pilot Stakeholders' Session

December 12, 2014

THE UNIVERSITY OF ARIZONA

UA Collaborative Learning Spaces Workshop
October 29 – 30, 2014

Facilitated by Jeanne Narum, Learning Spaces Collaboratory and
Andy Labov, CO Architects

Day One: October 29, 2014 (12:30pm – 5:00pm)

Time:	Topic:	Facilitators:	Location:
12:30 – 1:00pm	Welcome and Introductions	Gail Burd, Andrew Comrie, Karen Williams	SEL CLS*
1:00 – 1:20pm	Observe Chemical Engineering 201	Paul Blowers	SEL CLS*
1:30 – 2:00pm	At-the-Table Discussions – Why do we bring students together? How does space impact learning activities?	John Pollard	McKale HOC**
2:00 – 2:30pm	How spaces work; Why spaces matter	Jeanne Narum, Andy Labov	McKale HOC**
2:30 – 3:00pm	Overview of Science-Engineering Library Collaborative Learning Space (CLS) pilot	John Pollard, Paul Blowers, Vicente Talanquer, Lisa Elfring	McKale HOC**
3:00 – 4:00pm	At-the-Table Exercise - Exploring individual definitions of what collaborative learning means; arriving at a shared language	Jeanne Narum, Andy Labov	McKale HOC**
4:00 – 4:30pm	Break, Poster Session		McKale HOC**
4:30 – 5:00pm	Day 1 Wrap Up – What we already know and what we need to know	Gail Burd	McKale HOC**

Day Two: October 30, 2014 (8:30am – 12:00pm)

Time:	Topic:	Facilitators:	Location:
8:30 – 8:50am	Breakfast/Share Audacious Questions	Jeanne Narum, Andy Labov	SEL Patio at Entrance***
8:50 – 9:15am	Welcome Back, Summary and Next Steps	Gail Burd	SEL Patio at Entrance***
9:15 – 9:30am	An Architect's Perspective	Andy Labov	SEL CLS*
9:30 – 9:45am	Highlights of Spaces at Peer Institutions	Jeanne Narum, Andy Labov	SEL CLS*
9:45 – 10:30pm	At-the-Table Exercise – Imagining the Ideal Space	Jeanne Narum, Andy Labov	SEL CLS*
10:30 – 11:00am	Break, Poster Session		SEL CLS*
11:00 – 11:30am	Overview of UA Spaces: Constraints and Opportunities, CLSP Project Schedule	Gail Burd, Karen Williams, John Pollard	SEL CLS*
11:30am – Noon	Open House – All interested faculty, administrators and students	Gail Burd, Jeanne Narum, Andy Labov	SEL CLS*

*   Science-Engineering Library Collaborative Learning Space (CLS)
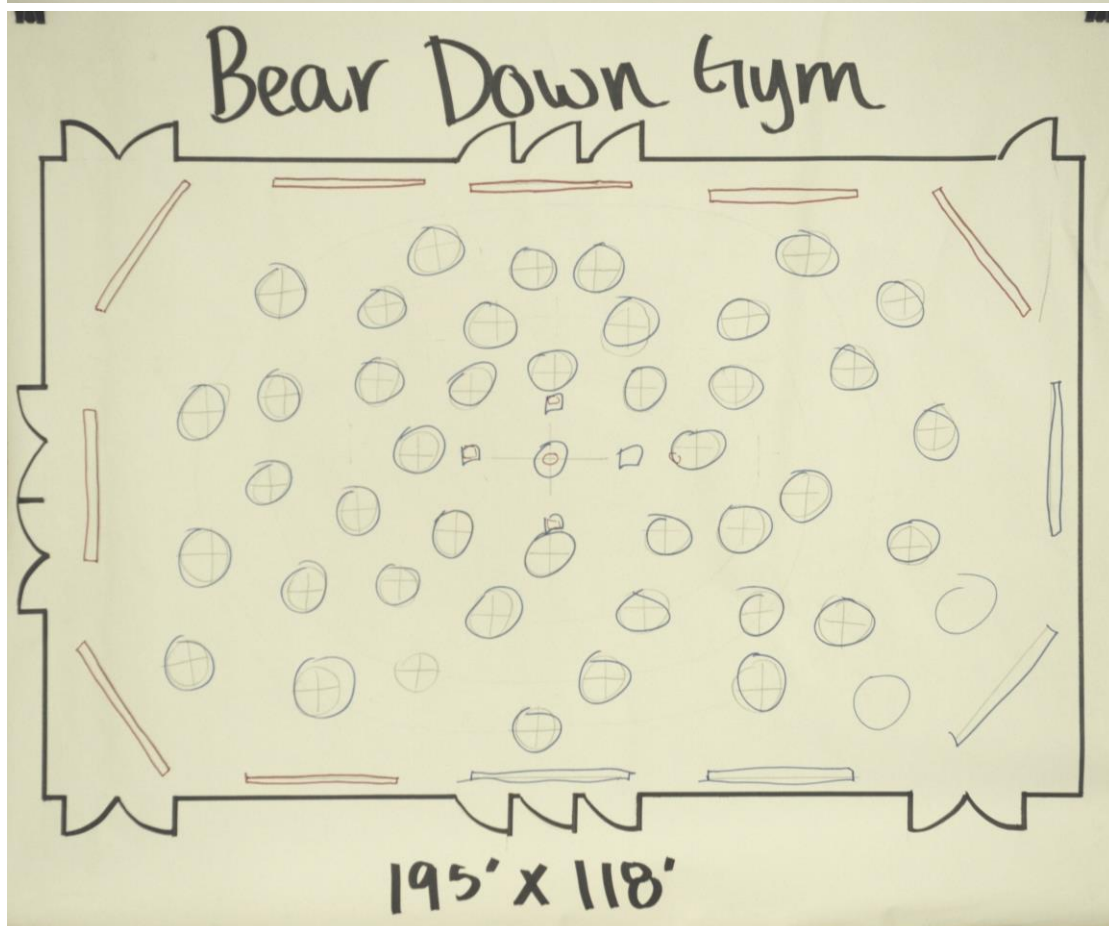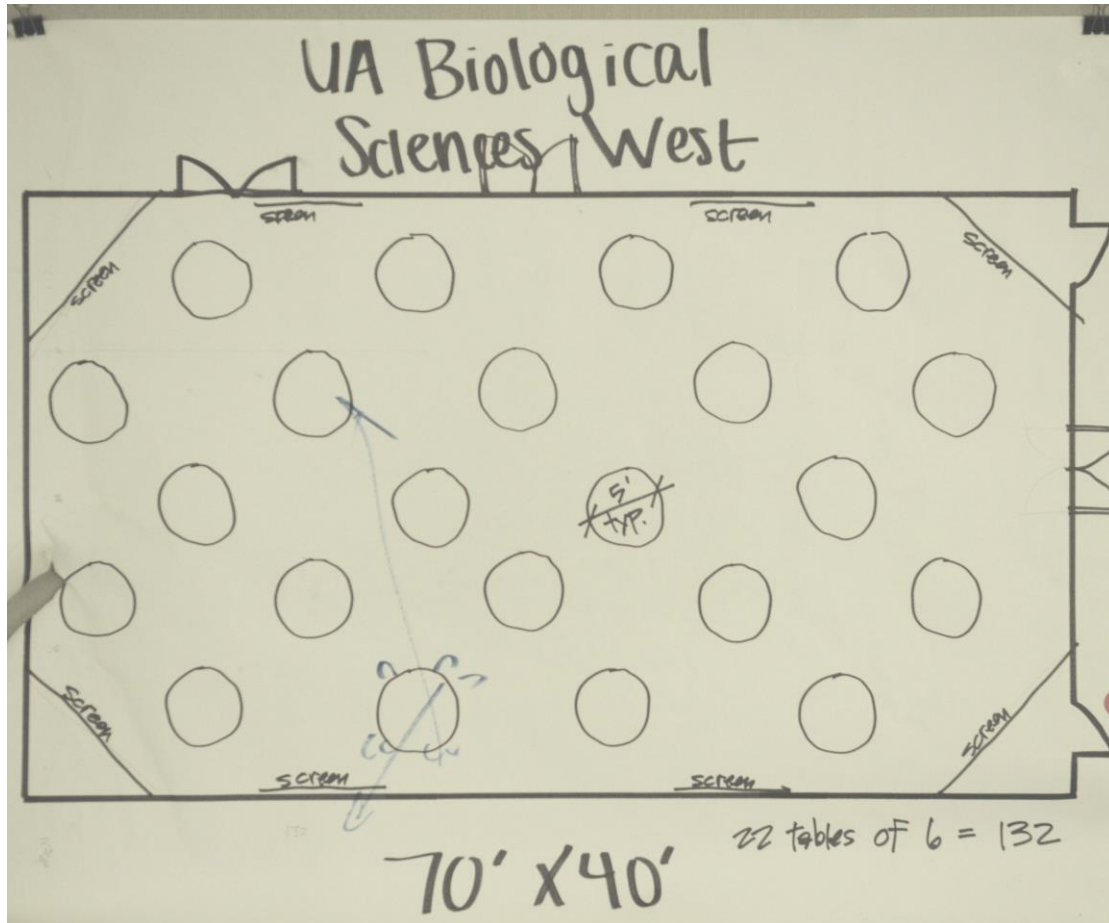**   McKale Center Hall of Champions
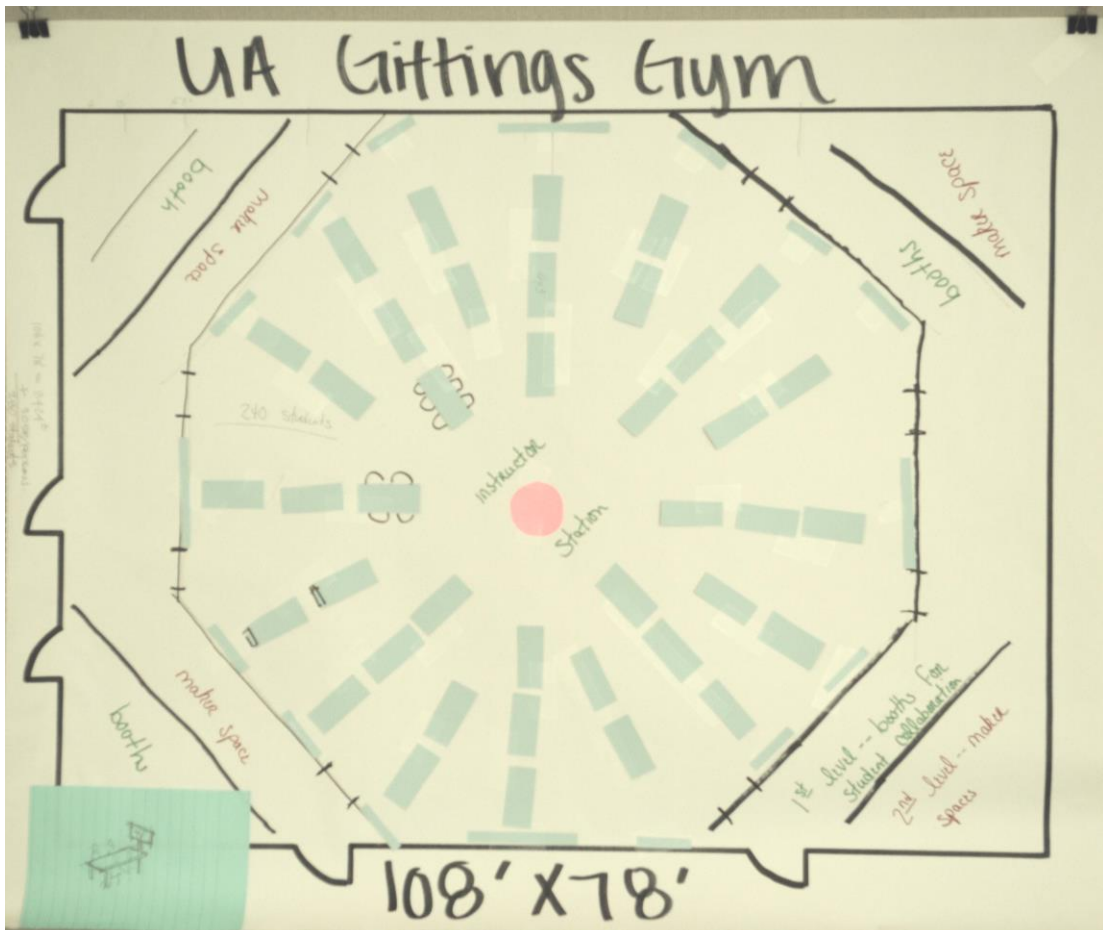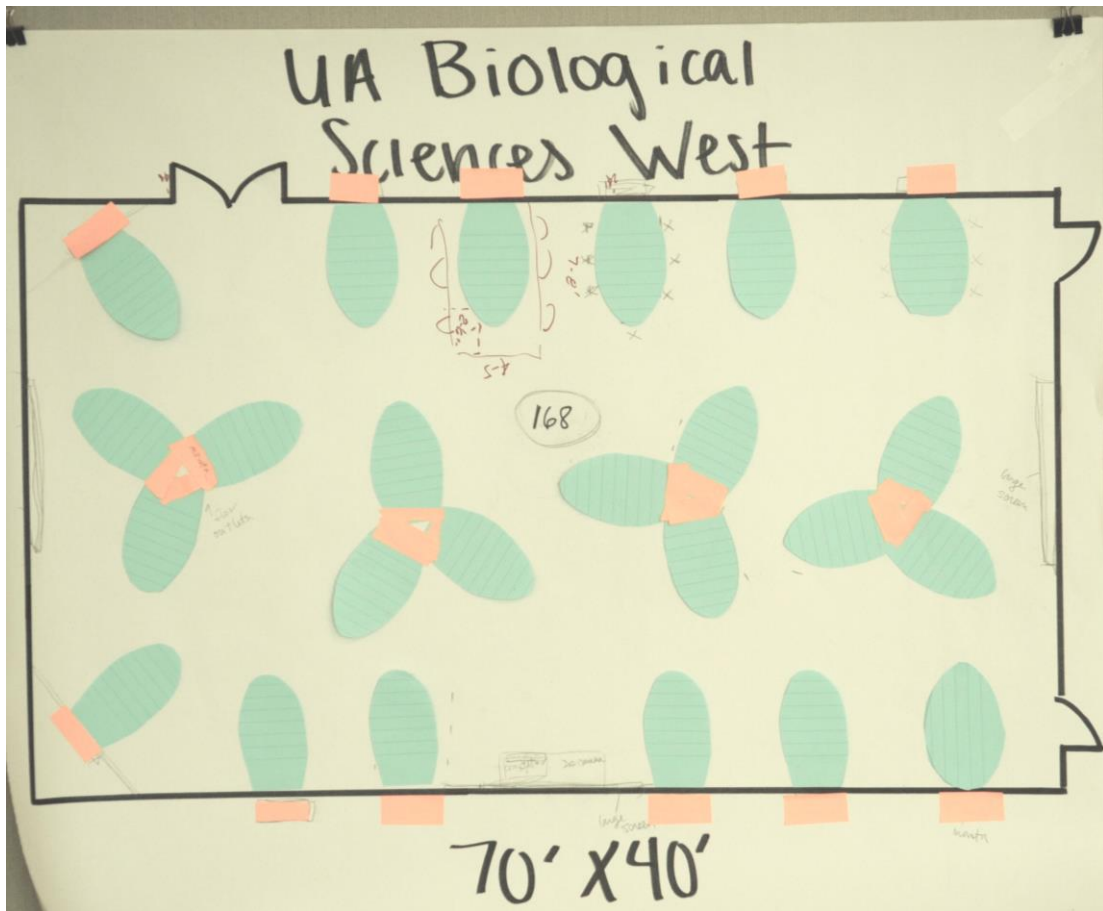*** Science-Engineering Library Patio at Library Entrance

Attachment 8: Andy Labov, CO Architects, Slides
(Double-click image to open the PDF)

UA Biological Sciences West

70' X 40'

22 tables of 6 = 132

Bear Down Gym

195' X 118'

UA Biological Sciences West

168

70' X 40'

UA Gittings Gym

108' X 78'

UA Science-Engineering Library Collaborative Learning Space (CLS)

113' x 55'

Small Monitors
Tables
Large Monitors (
Wall Projections

USE WALL SPACE
ABILITY TO SEE MONITORS
SHARE AT THE CENTER
COLL. AT THE CORNERS