A Study of Trends in Pedagogy at Purdue
Analysis on the Impact of Changes in Pedagogy and Study Needs on Facilities
A Study of Trends in Pedagogy at Purdue University

Analysis on the Impact of Changes in Pedagogy and Study Needs on Facilities

Volume 2  |  Appendix

Prepared for:
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Provost and Vice President for Academic Affairs
Purdue University

By
DEGW

30 June 2012
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Appendix:

A. Interviews with Key Constituent Groups

B. Environmental Scan:
   Trends in Pedagogy at Other Universities

C. Environmental Scan:
   New Learning Facilities at Other Universities
Interviews with Key Constituent Groups
Appendix: A. Interviews with Key Constituent Groups:

Libraries
Interviews with Key Constituent Groups

A Libraries Discussion Themes

Feedback on the Hicks B848 Active Learning Space

Hicks B848 is a 117-seat active learning classroom that is open to use by IMPACT faculty who submit a proposal describing how they intend to use an active learning space to strengthen and enhance the teaching methods and overall learning experience of the course. In the course of our meetings with various faculty, we interviewed Larry Nies – Professor of Civil Engineering – who teaches “Engineering for the Planet” in B848. He offered several feedback points about the experience of teaching in the space.

• He is very positive about the reconfigurable nature of the space. He indicated that students frequently move tables and chairs during class sessions.
• He never lectures for the full 50 minute class period. Instead, he segments the class sessions into several activities and walks around among groups of students.
• Guest lecturers occasionally visit the class and present material to the students. Because the class is not usually configured for lecture (something Professor Nies prefers to avoid), students to the middle of the space, between the columns.
• Students have a tendency to face forward in the room and not turn around to view the monitors in the back of the space.
• Because the columns in the room are obstacles, Professor Nies has asked for monitors to be installed on them in order to reanimate the dead zones that they create.
A Observations from Libraries Tour

Hicks B850-853
- 90-seat active learning space – dedicated for IMPACT – to be completed by Fall 2012
- Other than projection technologies, the space will be relatively low-tech
- Designed with an emphasis on group problem solving; the space will include small break-out rooms to support group work

Hicks G950
- Formerly occupied by the ITaP Digital Learning Collaboratory
- New “iLab” space – dedicated for IMPACT – will be completed by Fall 2012
- The space will support SCALE-UP classes
- The space will consist of 9-person tables, printing areas, a center-stage areas, and multiple flat panel monitors (2 monitors for every 3 tables) throughout the space
- The 24/7 space is located adjacent to the Undergrounds Coffee shop and will be designed for informal study and group collaboration outside of scheduled class hours
Observations from Libraries Tour

Parrish Library 2nd Floor Main Study Space
- Large open area consisting of a variety of collaborative spaces and seating types
- MediaScape pods enable students to collaborate and project material (popular with engineering students)
- An unintended consequence of the space is that it is always in demand for events

Parrish Quiet Study Room (258)
- Quiet formal study space with hard seating
- Designed to blend “traditional” and high-tech learning methods

Parrish Learn Lab (250)
- Computer lab classroom used for scheduled classes; otherwise available for student use outside of scheduled class hours
- Only available to faculty who redesign their course teaching methods to incorporate active learning
- Library staff are trained on the space’s IT, and can support users as needed

Parrish Mini Classroom (202)
Small flexible space that can be opened to the main open study area or cordoned off for meetings or classes
Observations from Libraries Tour

Parrish Financial Conference Room (230A)
Conference room configuration that is used for seminars and formal meetings such as job interviews but is otherwise available for students to use on an ad-hoc basis when not scheduled.

Lilly Library Group Study Area
- Frequently occupied space
- Although Lilly is a life sciences library, mostly non-life science students use the space
- Library staff help students with common IT requests (fewer reference requests)
- The 4th floor of the library could be converted to an active learning space

HSSE Library
- HSSE was renovated in 2002-03
- HSSE is designed to appeal to those who want to work in a “traditional” library setting
- Compared to Hicks (which is more of a social study space), HSSE provides more quiet study space
- Collaborative study center in HSSE provides information literacy training; some staff envision more virtual training that can be supplemented with specialized 1-on-1 training in the library
Appendix: A. Interviews with Key Constituent Groups:

Information Technology at Purdue
Interviews with Key Constituent Groups

A ITaP Discussion Themes

The Digital Learning Collaboratory and the Shift to Decentralized Support

ITaP leaders discussed the evolution of the Digital Learning Collaboratory (DLC) space in the Hicks Library. DLC was a state-of-the-art center when it opened in 2002, and it was indicated it consistently ranked as one of the top 2-3 utilized spaces on campus. The space served as a central service hub for resources and support for strengthening computing literacy. As ITaP is strategically decentralizing campus computing support across campus, the DLC space is currently being transformed into an active learning classroom. Currently, 40% of campus computing labs are controlled by ITaP, and this number is trending down. ITaP currently operates specialized computing centers, but it is turning over many of its spaces for scheduled classes.

Demand for Specialized Computer Labs

Based on their knowledge of utilization data, ITaP participants indicated that the demand for specialized computer labs is actually lower than what they currently provide. Computer labs do not require the same level of technical support staffing that was required 5+ years ago. Because of the increasing levels of mobile work patterns among students and faculty software and IT support is shifting from centralized labs to the classrooms and other areas around campus.
ITaP Discussion Themes

**Student Laptop Requirements and Mobility**

University leaders continue to have ongoing discussions around student laptop usage. Students are not currently required to purchase laptop computers, however many students do so. Some university leaders are reluctant to “pull the trigger” and require students to purchase laptops out of concern that laptop and software license costs will increase the overall cost of attendance. Cost of attendance is a variable that concerns university leaders in the context of the current economic climate.

Another reason that was cited as a basis of the reluctance to the laptop requirement is faculty discomfort with mobile computing and cloud-based software. It has been suggested that students are more comfortable than faculty in embracing mobile technology in the classroom and that the IMPACT program should focus on changing the mindset of faculty. Because many software applications are available online through Software Remote, students have the flexibility of using their own laptops to access applications for specific courses. Those who favor a laptop requirement argue that mobile computing aligns with the realities of today’s workplaces and that faculty should encourage learning practices that prepare students to compete in a competitive job marketplace.

Ubiquitous laptop use and the availability of cloud-hosted software would limit the demand for dedicated computer classrooms by giving faculty more flexibility for scheduling classes. Doing so will promote more classroom flexibility and will ultimately enhance active teaching/learning methods. Computer lab classrooms could be converted to new learning spaces (see next page) that support mobility, active learning, and virtual collaboration. TelePresence, other forms of video conferencing, or data visualization tools are seen as long-term options for today’s ITaP computer classrooms.

The demand for computer lab classrooms is not expected to completely ebb. A desktop computing platform is still the preferred platform for working with certain software applications, but ITaP predicts that the demand for desktop computing will diminish. ITaP predicts that the demand for “surge space” (space that is only needed for short durations, rather than for an entire semester) will increase. Some faculty book ITaP spaces for an entire semester when the need is for those spaces is less.
Interviews with Key Constituent Groups

A ITaP Discussion Themes

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ITaP Computer Classrooms

- An opportunity exists to convert ITaP computer classrooms into new types of learning spaces for active learning.
- As student laptop use and cloud-based software use concurrently increase, the demand for classrooms with dedicated desktop terminals will decrease. These trends will allow for the reconfiguration of ITaP computer classrooms.
- The table to the left lists the average size of class sections scheduled in each ITaP computer classroom between Fall 2010 & Spring 2012.
- The sizes of the class sections scheduled in ITaP computer classrooms are often less than the capacity of the spaces. This suggests that these spaces could be converted to active learning classrooms at a greater square-footage-per-student without greatly impacting the availability of space for the various class sections that use the ITaP classrooms.
- Faculty could continue to schedule class sections in these spaces, but the spaces could be configured to support more active engagement. Instead of using desktop computers in fixed configurations, students could use laptops and more easily collaborate and share content with peers.
ITaP Discussion Themes

A “Bring Your Own Device” Paradigm Will Reshape Active Learning
Currently, classroom IT infrastructure is consistently configured across campus. Classrooms are equipped with a relatively standard suite consisting of computer terminals for instructors as well as projection technologies for sharing content. As students and faculty are increasingly adopting a wider range of mobile technologies (laptops, iPads, smart phones, etc.), ITaP leaders envision that active learning classrooms of the future will need to increasingly support and interface with this wider array of devices and applications. As students increasingly adopt a “bring your own device” paradigm, active learning classroom technology will become more A/V-focused as the demand for sharing information from multiple sources intensifies.

Online Access to Content is Reshaping the Lecture Format & Informal Student Collaboration
Faculty are increasingly placing lecture content on the web and having students access the content before class. In many cases this online content is replacing textbooks. Instead of taking time in advance of a lecture course to read textbook material, student are taking the time to view online lecture content. By providing online content in advance of a lecture session, faculty have increasing flexibility to use lecture sessions for more active teaching methods that engage students in interactive discussions and problem solving exercises.

As the viewing of online lectures become a more standard aspect of students’ routines, it is becoming a more collaborative experience. Students are taking the time to view lectures in small groups in order to increase their understanding of content. As collaborative viewing of online content becomes a more ubiquitous practice, informal spaces for projecting and engaging with content will be in greater demand.
**“High Touch” Experiences Still Have a Place in a “High Tech” Learning Landscape**

As new technologies are increasingly adopted in the classroom, some faculty express reservations about the pace of technological change and their ability to leverage many of these changes in a meaningful way. Faculty find that some technologies such as “intelli-boards” (digital whiteboards) are very useful at enabling more interpersonal dialogue and face-to-face interactions among students and faculty. Yet some faculty are concerned that students “hide behind their digital devices” and are not strengthening their ability to verbally communicate and express ideas. Some faculty workshop participants noted that utilizing the university’s program to “take a student to lunch” is a traditional “low tech, high touch” way to engage with students in meaningful ways.

Interestingly, active learning changes the relationship between faculty and students and loosens the boundaries between them – nurturing more casual interactions. As active learning increases and facilitates faculty-student dialogue, a greater variety of informal spaces will be needed to support these interactions. While faculty-student interactions may have been limited to brief conversations after class in the front of a room or during faculty office hours, informal collaborative areas near lecture halls and other classrooms can invite greater levels of informal dialogue and lingering discussions in an active learning format.
A ITaP Discussion Themes

Other Trends in IT Demands to Support Active Learning Methods

- Remote sensing technologies
- Increasing interest in accessing and using real-world data sets (i.e. GIS data)
- Use of data visualization in active learning courses
- Innovative infographics
- More ubiquitous access to power (for laptops and mobile computing devices)
- More seamless capturing, storing, and disseminating of lecture content

Today
Consistent pedagogical methods supported by a standard suite of information-access technologies

Tomorrow
Variably active learning methods supported by a wider range of information-sharing technologies
Appendix: A. Interviews with Key Constituent Groups:

Residential Life
Residential Life

Residence Hall Spaces Will Increasingly Support Informal Collaborative Study

Campus housing redesign efforts will generally adhere to a principle of equipping each space with features that give environments a “day life” and a “night life.”

Housing is in the process of adding “Collaboratories” to each residence hall, which will include plug and play configurations to support interactive collaborative group study.

An academic success center will be added to Shreve Hall, which will include a variety of collaborative seating configurations for group study as well as flexible office spaces for student meetings, faculty office hours, or TA office hours.

Collaborative spaces in housing units will increasingly incorporate “high end vending” options for food and beverages (similar to those featured in the redesigned Parrish Library in the Krannert School), which will encourage students to linger in spaces for longer periods of time.

A new residence hall will be built on Vawter Field between Wiley and Windsor residence halls. The new hall will include a classroom that will have separate access for non-residents, which will allow greater flexibility in the scheduling of classes in the space.
Appendix: A. Interviews with Key Constituent Groups:

Center for Instructional Excellence
Center for Instructional Excellence

Discussion of the Faculty Commons Concept

We discussed the tentative Faculty Commons concept, whose organization is being conceived as a “one stop shop” for faculty resources and consulting on active learning methods. The Faculty Commons would encompass support from various groups such as CIE, ITaP, and the libraries that could assist faculty on instructional design. Discussions about the Faculty Commons concept focused on the need for campus leaders to clearly define the roles and responsibilities of the various participating units whose current services, missions, and responsibilities overlap.

One proposed conceptualization of the Faculty Commons is a space that offers retreats, workshops, and training sessions for faculty. Informal social spaces and coffee areas were mentioned as an important feature of bringing people together. While the Faculty Commons would likely house representatives from the various participating campus units who could provide direct instructional design assistance, it was emphasized that the individuals participating in the Faculty Commons should be amenable to its mission and be willing to work with colleagues in other units to ensure smooth operation and to avoid turf issues.
Appendix: A. Interviews with Key Constituent Groups:

College of Agriculture
College of Agriculture

Active Learning in the College of Agriculture

Despite a trend toward larger classes in agriculture colleges at other universities, the COA at Purdue is pursuing the design of smaller active learning courses in the curriculum. To support active learning, COA is collaborating with ITaP, the Teaching Academy, CIE, and the libraries. Because of this alignment among these groups, Purdue is strongly positioned – relative to other research universities – to achieve its stated goal of promoting active learning across the campus.

Barriers to Active Learning

We discussed the need for Purdue University (including the College of Agriculture), to provide and expand opportunities for teaching innovation, and find the means to effectively incentivize the teaching and programmatic development efforts of pre-tenure and tenured faculty, and non-tenure track classroom/field instructors. Teaching and advising efforts must align with the faculty reward and promotion structure.
Appendix: A. Interviews with Key Constituent Groups:

College of Education
College of Education

Active Learning in the College of Education

The College of Education embraces active learning to the extent that it mirrors the methods that its students are expected to adopt as they become teachers. Students typically enter the college as sophomores and take several large enrollment courses (~200-400 students per section). Ideally the college would limit the size of these foundational courses to no more than 100 students per course section. Beyond the introductory courses, the college has class enrollment targets of approximately 20 students per undergraduate course and 10 students per graduate course.

Information technology is a major aspect of the college’s approach to active learning. Many undergraduate courses are clinical in nature, which could benefit from better technology that could connect students to remote classrooms (in synchronous and asynchronous ways). The college is currently a heavy user of video recording technology and internet bandwidth, and they have their own in-house instructional design expertise.

Students in the College of Education learn in hands-on ways, and much of their experience is embedded in immersion in real-life classroom settings in schools.
Interviews with Key Constituent Groups

A College of Education

Demand for Active Learning Spaces

The college desires learning spaces that reflect and facilitate the instructional methods that students will be expected to use when they become teachers. The college does not currently have space where they can simulate a variety of K-12 classroom configurations. Their current spaces do not support their pedagogical methods. They need spaces where simulated classrooms could be configured for as short as a week or for as long as a semester. Among the expressed desired features for active learning spaces:

- Rooms with multiple smart boards
- Multiple display surfaces
- Writeable boards (writeable tables are not as important)
- Technologies that interface with a variety of hand-held devices such as iPads, smart phones (handheld devices work best in K-12 classrooms)
- Multi-use spaces for foundational courses
- Flexible method rooms for storing materials
- Advanced video technologies that enable recording of student teaching as well as video conferencing technologies that “bring the outside into the classroom” (i.e. rural classrooms, urban classrooms)
- Upgrades to existing wet lab space
- Humanities lab space (i.e. digital humanities or multi-media lab)

Informal study spaces like those in the Parrish Library would not be appropriate for College of Education students, as students “do not need to spend time in carrels staring at computers.”
Interviews with Key Constituent Groups

College of Education

Changes in Course Delivery

“Presently there are only six courses within the College of Education that may be classified in this manner [as active learning]. Of these, EDCI 27000 has been a part of IMPACT in the past year. We are re-examining our curriculum for our foundational courses and hope to create additional opportunities for active student engagement during class time...We are continuing our efforts to integrate active learning strategies and the use of technology into the classroom at all levels of instruction. Hybrid approaches are being increasingly used in courses beyond the first/second year foundational course level.”

“Our science and math methods courses have a strong emphasis on skill-building, micro-teaching, and experiential learning. However, they are not first/second year foundational courses. “STEM Goes Rural” courses, because of the heavy clinical emphasis, already have components delivered via hybrid format.”
Spatial Implications

“As a College with a strong emphasis on teacher preparation, we recognize the need for our faculty to model cutting edge instructional approaches for our students, particularly those involving problem-based learning. Our desire to move in this direction has been hindered by our very traditional classroom space. We have had multiple conversations about the need to create more interactive classroom space in BRNG aimed at small or medium enrollment classes, our typical format.”

“We are not currently teaching any courses in IMPACT classrooms; however, one of the two sections of EDCI 27000 is scheduled to be in the Hicks Library IMPACT classroom for the fall 2012 semester. Only six courses presently have seat needs for more than 150 seats; EDCI 20500, 27000, 28500; EDST 20000; EDPS 23500, 26500.”

“As mentioned earlier, we believe that it is critical that there be interactive classroom space for small and medium sized courses that will enable our students to experience and practice the critical problem-based learning skills they will need in their future work as educators. A conservative estimate is that at least 50% of all classes, and up to two-thirds of first/second year foundational courses, should be taught in these settings.”
Hybrid Teaching Mix
“Currently 50% (3/6 courses, or 9 of 18 credit hours) of our first/second year foundational courses has a hybrid component of some type...[In the next 10 years, that number is expected to increase to two-thirds.]...[Scheduling and space allocation] is hard to estimate – although it is possible that greater use of technology could reduce the need for regular use of campus space, the need for skill development and active feedback for our pre-service teachers likely will mean that a majority of course efforts will remain face-to-face but with increased access to more functionally appropriate space.”

Demand for Informal Learning Space
“Our Teacher Education sophomores would benefit from greater involvement in flipped classrooms, with lectures available online and class time spent working in small groups on structured activities...Our faculty regularly comment about the lack of collaborative and informal learning space within Beering, and we have actively explored space solutions to address this issue. As our focus on active and collaborative learning increases throughout our curriculum, it is likely that the need for this type of space will significantly increase.”
Appendix: A. Interviews with Key Constituent Groups:

College of Engineering
Active Learning in the College of Engineering

The active learning design of ENGIN 131 represents a desired future trajectory for the college curriculum. ENGIN 131 integrates the Armstrong Hall i2i lab into the course experience, providing first-year students with activities that mimic the stages of the design and innovation process (from experimentation to prototyping to continuous refinement). The adjacencies of learning studios and prototyping labs reinforces this concept. Civil engineering also incorporates an i2i lab in its building, which leverages a similar strategy of offering students prototyping tools in a flexible and reconfigurable learning studio.

Active learning spaces support teaming, which is a pedagogical approach the college increasingly advocates. The i2i spaces reinforce teaming through flexible design, tools to support the visualizing of work, writeable surfaces, and the lack of “head” space (to negate an otherwise didactic pedagogical approach). The college is currently designing a new building to support teaming and collaborative student projects. The i2i concept will inform the design of the space, and it will incorporate larger team projects (20-25 “think oriented” projects at a time).

The need to ensure students’ successful transition to the engineering curriculum is a key driver of the college’s embrace of active learning principles.
Demand for Active Learning Spaces

Discussions with facilities planners in the college indicated a growing demand for a variety of spaces to support active learning:

- Machine shops
- Electronic shops
- Teaming rooms
- Student project space
- Student club space

Other schools within the College of Engineering have expressed a desire for creating their own i2i space. Electrical and Computer Engineering wants to create an i2i lab, and they would like to create more space where teaming is possible. The school has created some small spaces for themselves but a lack of funding limits their ability to do more at this time. ECE may seek to develop new spaces through the IMPACT program.

In addition to i2i spaces, the college is redesigning lecture halls using a “two-per-tier” configuration, which preserves the sight lines of a lecture format while enabling better circulation within the space for various learning activities.
## College of Engineering

### Large Enrollment Courses

<table>
<thead>
<tr>
<th>Enrollment</th>
<th>Fall 2010</th>
<th>Spring 2011</th>
<th>Fall 2011</th>
<th>Spring 2012</th>
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<tbody>
<tr>
<td>ENGIN 131</td>
<td>1,704</td>
<td>185</td>
<td>1,764</td>
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<td>ENGIN 132</td>
<td>204</td>
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<thead>
<tr>
<th>Structure</th>
<th>Lecture Sections</th>
<th>Recitation Sections</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGIN 131</td>
<td>• 120 students/section • 1 faculty member • 1 graduate TA</td>
<td>• 120 students/section • 1 graduate TA • 3-4 undergraduate peer TA’s</td>
</tr>
<tr>
<td>ENGIN 132</td>
<td>• 120 students/section • 1 faculty member • 1 graduate TA</td>
<td>• 120 students/section • 1 graduate TA • 3-4 undergraduate peer TA’s</td>
</tr>
</tbody>
</table>
A College of Engineering
Large Enrollment Courses

Technology
The i2i approach to active learning in the College of Engineering is designed to reflect the principles of the design cycle. Technologies that support rapid prototyping are used in i2i labs.

Demand for Classroom Space
The college’s i2i format is likely triggering a long-term demand for more active learning spaces. As first-year students are exposed to active learning principles and teaching/learning methods in an i2i format, students and faculty may demand additional spaces to support a wider adoption of this approach throughout the curriculum. The ideal size for active learning groups in engineering courses is 4 students per group.

Demand for Non-Classroom Space
Students typically work in teams of 4. Groups that are larger than 4 students pose scheduling difficulties that constrain coordination.
ENGIN 131/132 introduces students the teaming concept as a key collaborative aspect of the engineering curriculum

Factors that Constrain the Adoption of Active Learning
Larger sections of i2i-format active learning classes could be designed (double or triple the current size of 120 students) if space and manpower resources proportionally increased.
Because of the variation in the range of programs across the 14 schools within the College of Engineering, active learning principles may not be consistently embraced.
Appendix: A. Interviews with Key Constituent Groups:

College of Liberal Arts
Active Learning in the College of Liberal Arts

In discussing the possibility of incorporating more active teaching and learning methods into large enrollment courses, we discussed that the faculty would prefer to teach smaller courses. Even if a large enrollment course could be redesigned in a more active manner, it was suggested would always prefer to teach smaller sections instead of larger sections. In discussing the possible incorporation of active learning elements to the large enrollment English and communications courses (incorporating more multi-media content access, library support, etc.), it was suggested that several other courses in different departments (i.e. history, art history, literature, and political science) could incorporate similar changes. One of the college’s pedagogical characteristics is its hands-on approach to teaching liberal arts. This approach could align with shared active learning course design practices.
College of Liberal Arts

Liberal Arts Students at Purdue
In discussing the reasons why students major in the liberal arts at Purdue, the following reasons were discussed:

• Non-liberal arts students are looking for different ways to analyze problems
• Purdue is refocusing efforts on attracting liberal arts students by giving them more hands-on experiences through the colleges

Characteristics of Purdue Liberal Arts Students
Characteristics of Purdue liberal arts students:

• Oriented toward professional development and applied careers
• Interested in hands-on experiences, study abroad, internships, service learning
• Seek creative endeavors to complement their engineering experience
• Prefer visual and tactile learning experiences
A College of Liberal Arts

Unique Demand for Departmental Learning Spaces
Although the university provides students with a variety of campus-level spaces, there is an unmet demand for departmental spaces in the college where undergraduate students can socialize, study, and work with peers and faculty. Departmental spaces are largely oriented toward graduate students, which are not inviting to undergraduate students. Departmental spaces help reinforce disciplinary identity and can facilitate the transfer of discipline-specific resources.

Online Learning Resources
The College of Liberal Arts favors the development of online lecture material for larger classes. Larger courses have more financial resources for developing online content. Developing online content for smaller enrollment classes can be perceived as a threat to the roles and responsibilities of graduate student TA’s.
Changes in Course Delivery

“The College of Liberal Arts has made various changes in the design and delivery of first and second year foundational courses. First, the most recognizable change is transforming ENGLISH 101 and 102 into English 106. The Department of English turned two traditional lecture and recitation courses into one 3-credit courses of individual conference, composition, and recitation. Second, the Department of History started offering online courses of large lecture courses. Third, the Brian Lamb School of Communication now has online COM 114 courses. Lastly, the Department of Anthropology added recitation and lab sections to ANTH 101, 201, and 204 and will add them to ANTH 154 and 156 in 2013. Smaller-size classroom sessions and hands-on lab experiences are necessary and important for these courses.”

“There will be increased numbers of online courses, which does not mean substantially fewer courses taught face to face in the classroom because some of the current online courses are created due to space issues. Also there will be more small discussion, recitation or lab sections for large lecture courses since dividing students into small groups will aid students to learn better and also assist faculty to provide more individualized attention to each students.”

“Current needs of spaces will remain the same for these courses. Foundational courses will remain as essential introductory courses that emphasize on face to face interactions and hands-on experiences in classroom. We do not anticipate any drastic reduction on in-class contact hours but perhaps there will be more small discussion or lab sections of large lecture courses.”
Spatial Implications

“Among the schools and departments of College of Liberal Arts, Department of Sociology offers most of courses taught in IMPACT classrooms (SOC 100, 220, and 310). In our estimate we generate 3,000 class hours each academic year.”

“The schools and departments of CLA are certainly interested in more interactive classroom spaces. For example, small and large classroom spaces are divided into table of 8-10 seats with multiple screens. Current classrooms with bolt down chairs are not helpful to create interactive learning environment. New space designs will support instructors to give more individualized attention to each student in and out of classroom. One of suggestions given by department heads was about ‘flipped classroom’ learning.”

“As mentioned above, we need more interactive spaces. In ten years we hope to see at least 50% of our large lecture courses in interactive classroom spaces: 18,000 class hours per year.”
College of Liberal Arts

Hybrid Teaching Mix

“Most department heads were not aware of such hybrid mix possibilities. If this model is allowed, department heads are certain that a number of courses will adopt it...CLA anticipates that approximately 25% of undergraduate courses will adopt this model if allowed and encouraged. Particularly for sophomore, junior and senior courses will include this model for team work projects and research works.”

“This will lead to next question about informal learning spaces. As more courses adopt hybrid models, more spaces for team/collaborative works will be needed. And in terms of classroom scheduling and space allocation might be less complicated since online works and team projects will not take place in classrooms but in informal learning spaces.”
Demand for Informal Learning Space

“All the schools and departments of CLA underline the need of such spaces. They need a large classroom-size space (60 students) with multiple tables or two or three small classroom spaces (20 students each). Currently except of the School of Visual and Performing Arts (VPA), CLA schools and departments do not maintain such informal learning spaces. Although very limited, VPA has a limited number of informal learning spaces for performing arts such as theater, dance, etc. Also they have limited studio/lab spaces and VPA is in desperate need to expand them because team projects and collaborative works are the integral part of their courses, for example, industrial design and visual communication design courses. In my estimate total of 20 small classroom-size spaces (20 students each) will be needed for CLA.”

“As we focus more on interactive and active/collaborative learning, we will exponentially increase the number of courses that will require team projects. Most of the CLA schools and departments will be interested in hybrid learning models and the IMPACT classrooms. Therefore, though there is no data to document a potential level of demand, CLA department heads indicate the urgent need of informal learning spaces even with current course structures and designs.”
Interviews with Key Constituent Groups

College of Liberal Arts
Large Enrollment Courses | Communications

<table>
<thead>
<tr>
<th>Enrollment</th>
<th>Fall 2010</th>
<th>Spring 2011</th>
<th>Fall 2011</th>
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<tr>
<td>COM 114</td>
<td>3,005</td>
<td>2,224</td>
<td>3,041</td>
<td>2,144</td>
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</table>

<table>
<thead>
<tr>
<th>Structure</th>
<th>Lecture Sections</th>
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</thead>
</table>
| COM 114        | • Small sections of 26 students/section (100-120 sections offered each semester  
                   • All sections are taught by TA’s  
                   • TA’s adapt a standard class format and undergo continuous training before and during the semester  
                   • All class sections are managed for consistency |
Interviews with Key Constituent Groups

A | College of Liberal Arts
Large Enrollment Courses | Communications

Technology
• Blackboard is used for managing course content
• TA’s present web-based videos to demonstrate different types of presentations

Library
• Students are required to conduct research in preparation for their class presentations. They are encouraged to consult with librarians for the purpose of accessing information and evaluating the relevancy of the sources (information literacy)
• Because of the large enrollment and the large number of sections (100-120/semester), it is not practical to embed librarians in the course or establish formal information literacy requirements
Demand for Classroom Space

- Instructors would ideally use classroom spaces with improved technology that would enable students to give web based (virtual) presentations, which is an important pedagogical aspect of the course.
- Better classroom recording technologies would allow instructors to capture student presentations and upload them to Blackboard where students could access the recordings.

Demand for Non-Classroom Space

- COM 114 students are encouraged to conduct consult librarians, but many students currently do not do so.
- Students are encouraged to work in groups to practice delivering their speeches. This would necessitate small enclosed group spaces with display technology to support the sharing of supplementary content.

Factors that Constrain the Adoption of Active Learning

- Because of the nature of the subject matter, instructors currently utilize active teaching and learning methods and a range of in-class small group activities. The spaces currently utilized for the class sections are configured for lectures and are not appropriately designed for the nature of COM 114 activities.
- At 26 students/section, current class sizes are larger than the average of 22 students/section at other universities. Smaller class sections are preferred, but current space availability and manpower constraints prohibit the design of smaller class sections.
Interviews with Key Constituent Groups

College of Liberal Arts
Large Enrollment Courses | English

<table>
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<tr>
<th>Enrollment</th>
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<th>Spring 2012</th>
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<td>ENGL 106</td>
<td>2,894</td>
<td>2,379</td>
<td>2,801</td>
<td>2,553</td>
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<tr>
<th>Structure</th>
<th>Lecture Sections</th>
<th>Lab Sections</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGL 106</td>
<td>• 112 regular sections of 20 students/section</td>
<td>Lab sections in computer lab spaces are used to teach multi-media presentation skills and engage in writing exercises.</td>
</tr>
<tr>
<td></td>
<td>• 25 international student sections of 15 students/section</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Graduate students teach the course and choose from 1 of 8 common approaches for the course</td>
<td></td>
</tr>
</tbody>
</table>
A College of Liberal Arts
Large Enrollment Courses | English

Supplemental Instruction
- No SI
- Students utilize the Writing Lab. It is desired that the Writing Lab remain in close proximity to the English department community because it actively supports graduate student research activities.

Technology
- Writing Lab online resources offer a variety of tutorials on bibliographic citations, formatting, writing styles, etc.
- Access to rich multi-media resources is an important aspect of ENGL 106.

Library
- Information and media literacy requirements are instrumental to the ENGL 106 course.
- ENGL 106 includes a rigorous section on methods for conducting research and critically evaluating sources.
College of Liberal Arts
Large Enrollment Courses | English

Demand for Classroom Space
- There is an overall interest in exploring options for integrating more active learning methods into the ENGL 106 course.
- The international sections of ENGL 106 currently use computer exercises in all class sessions and requires the use of collaborative seating for small groups.
- All sections of ENGL 106 could be configured for active learning, with students sitting in small group clusters. The instructor specifically referenced the “Collab Triage” (offered through SmartDesks.com) as an ideal configuration for the class sessions.

Non-Classroom Space
- ENGL 106 places a big demand on library services and could potentially demand more of the library in upcoming years. Students engage in a variety of research and writing projects that require the use of multi-media digital resources as well as traditional print materials.
- Because of the requirements for media integration into course project portfolios, there is a huge demand for non-classroom space beyond the scheduled class sessions.
- The discussion of ENGL 106 briefly explored the possibility of integrating the spaces required for the course into the library in order to facilitate better access to multi-media services

Factors that Constrain the Adoption of Active Learning
- “It is extremely difficult for students to collaborate on projects” (because of the multi-media availability constraints)
- Manpower and spatial constraints limit the opportunities for the adoption of more active learning methods.
Appendix: A. Interviews with Key Constituent Groups:

Krannert School of Management
Krannert School of Management

Active Learning in the Krannert School

Although the Krannert School curriculum has traditionally incorporated some forms of active learning (case study method and group project work), the college is looking to its peers in other business schools and within the university in adopting new pedagogical methods. The undergraduate program at the Krannert School has a high faculty to student ratio in which its largest courses are led by dedicated lecture staff. Research faculty typically do not teach large enrollment courses. Although the college does not utilize peer instructors for its undergraduate program, MBA students do assist faculty in large enrollment courses and do lead some recitation sections.

The Krannert School is in the early stages of planning for longer term curricular changes. Three of the school's faculty members will join the IMPACT cohort for the fall 2012 semester. Leaders recognize that with the growth of available online course content, the Krannert school must embrace more active teaching and learning methods that increase the relevance of in-class and on-campus experiences.
Interviews with Key Constituent Groups

A Krannert School of Management

Demand for Active Learning Spaces

A cultural divide splits the undergraduate students from the MBA and other graduate students. While MBA and graduate students typically utilize the Rawls Building, undergraduate students typically use spaces in the Krannert Building. Many of the undergraduate classes utilize the former MBA spaces in the Krannert building, which are configured in forum style arrangements for case study discussions. A long term desire is to incorporate more spaces like the Hicks Library B848 active learning space. Although it is relatively new, the Parrish Library space on the second floor of the Krannert Building has been widely used. Although undergraduates typically have less reserveable space than MBA students for group projects. Undergraduate students typically use space in a more ad-hoc way.
## Krannert School of Management
### Large Enrollment Courses

<table>
<thead>
<tr>
<th>Enrollment</th>
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<tr>
<td>ECON 251</td>
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<td>1,331</td>
<td>1,409</td>
<td>1,469</td>
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<td>ECON 252</td>
<td>713</td>
<td>752</td>
<td>803</td>
<td>713</td>
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<td>MGMT 382</td>
<td>352</td>
<td>352</td>
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<table>
<thead>
<tr>
<th>Structure</th>
<th>Lecture Sections</th>
<th>Lab Sections</th>
</tr>
</thead>
</table>
| ECON 251  | • Professor teaches large format sections (375-470 students/section)  
• Graduate TA’s teach 2 sections of 55 students/section | • A TA experimented with a behavioral lab in one past section  
• Otherwise, no lab |
| MGMT 382  | • Maximum 44-students per section  
• Maximum of 8 sections per semester | • Computer lab  
• Lab capacity (44 students) caps the enrollment of each section |
A Krannert School of Management
Large Enrollment Courses

Supplemental Instruction
- No formal SI
- ECON TA’s offer optional weekly review sessions for students who want additional help

Technology
- Top Hat Monocle clicker app that interfaces with students’ personal devices (ECON)
- ECON lectures are posted online through BoilerCast
- MGMT 382 teaches programming and database skills and uses computer labs with desktop computers for lab sessions.
- MGMT 382 is currently constrained by the need to conduct lab sessions labs equipped with desktop computers.
A. Krannert School of Management

Large Enrollment Courses

Demands for Classroom Space

- ECON 251/252 could be offered in smaller sections that facilitate more group interaction. Smaller class sizes enable the instructor to better assess students’ understanding of content.
- Better classroom technology could support more robust active learning methods in ECON. Although the instructor currently uses the Top Hat Monocle clicker app, some lecture halls do not offer sufficient Wi-Fi access to support its widespread usage. Active learning methods would enable the instructor to better grasp students’ understanding of course content.
- MGMT 382 could adopt a variety of changes to support active learning. Students could access online training modules before class so that class could be reduced to one large lab section for addressing student questions. Existing lab sections could be reconfigured as paired programming work sessions. A shift from desktop usage to laptop usage could offer a higher degree of flexibility.
- MGMT 382 does not require a traditional active learning studio with dispersed tables. Circulating among students is actually less efficient and more time consuming because the instructor typically answers very quick questions. The horseshoe-shaped lecture rooms in Krannert (former MBA spaces) work well for this course, as 40-45 student class sizes are ideal.
A Krannert School of Management
Large Enrollment Courses

Demands for Non-Classroom Space
- MGMT 382 students can use classroom computer labs later in the day when scheduled classes are complete. However many students use laptops. As laptop usage increases, students will be less bound to computer labs and dedicated spaces with fixed terminals.

Factors that Constrain the Adoption of Active Learning
- ECON 251/252 is currently organized as a large format course with staff dedicated to the course who ease the teaching load on research faculty. Shrinking class sizes would necessitate manpower increases.
- In its current format, ECON 251/252 could adopt more active pedagogical methods if additional TA’s were available to support the class.
- Krannert is generally trying to shrink its overall enrollment numbers in order to better align faculty resources and resource capacity with student demand for courses.
Appendix:  A. Interviews with Key Constituent Groups:

College of Pharmacy
Active Learning in the College of Pharmacy

Curriculum change in the College of Pharmacy has traditionally occurred in a very incremental way. Consequently, the college is cautious in its embrace of active learning because it is a professional program governed by professional accrediting agencies. Because of the lock-step nature of course sequences in which all students take the same courses, changes to the design of one course can affect the entire curriculum. Furthermore, curricular changes must coincide with pedagogical standards established by the accrediting agencies.

Nevertheless, the College of Pharmacy is adopting changes. The college will launch a new curriculum in the fall of 2012. Changes in instructional technology as well as the expectation that students take a greater responsibility for their learning are driving the redesigned curriculum (impacting both the pre-pharmacy undergraduate and PharmD programs). The Professional Program Laboratory course has undergone an IMPACT redesign and will be rolled out for the first time this fall.

Other long-term changes the college envisions are more collaborative lab sessions with nursing, dietetics, and IU medical school students. However more space would be required. The college would require a 40-person lab with additional breakout stations.
Barriers to Active Learning

The lack of space is currently a major constraint to the College of Pharmacy. It limits the ability to pursue widespread course redesign throughout the entire college. The college currently consists of the following spaces, which is about half of the available capacity of peer pharmacy colleges:

- Three classrooms with respective capacities of 190, 70, 30
- A single laboratory with 32 stations
- Two student lounges that can only accommodate about 30 students (~1,500 sf), which limits informal interaction

Service Courses in the College of Pharmacy

The courses that the college teaches to first and second year students are larger than what the college spaces can accommodate. The college outsources these service courses to other spaces throughout campus, as available. Faculty are interested in teaching these courses as efficiently. Some faculty are more interested in adapting different teaching methods, but they are mostly interested in doing so for the non-service course
Interviews with Key Constituent Groups

College of Pharmacy

Changes in Course Delivery

“The College of Pharmacy provides limited instruction in the first and second years of college. We teach an orientation course, two organic chemistry courses, an immunology course and a biochemistry course. All of these courses are high enrollment (200-300). These are pre-requisite courses for our 4-year professional program in pharmacy (Pharm.D.). We have not talked about making significant design or delivery changes in these courses.”

I believe we will expect more preparation of students outside the classroom (e.g., prior viewing of videos, working through on-line modules, group project work on-line) and use class time for problem-solving, case studies and applications of content. We will most likely experiment with on-line versions of these courses that could be taken by our students as well as students from off-campus who wish to meet our pre-requisite requirements. It would be desirable to have additional small group breakout/project work space, but we would need to have additional instructor resources to manage courses in that environment…I anticipate the courses will continue to be large-enrollment courses.”

“We rely on other colleges for much of our first and second year instruction. Through the use of course liaisons, we have worked with other departments to incorporate life-sciences examples and content in our pre-requisite courses (e.g., CHEM 109, MA 231-232, BIO 301-302). For those courses that we teach, we emphasize applications of material to other companion courses in a given year.”
Spatial Implications
“For students in our professional program, we would like to have additional breakout/group project work space...In our current professional program, we probably have 80% of our class time in traditional large lecture format (150-180 students). If we had the faculty resources and space configurations, we would like to move that percentage to about 60%.”

Hybrid Teaching Mix
0% of first and second-year courses are hybrid today. In ten years, it is anticipated that the number will increase to 10%...It is “hard to change much with the current space availability.”

Demand for Informal Learning Space
“We have very limited [informal collaborative space] in our college. We need a significant increase in study rooms, breakout space, and group project work areas...The trend is obviously toward collaborative study and informal learning opportunities both in our college and across the campus. We just made significant curricular changes, but have had to do so within the context of currently available space. I suspect if we have additional flexible space, we would find ways to change our curriculum to make use of it extensively.”
Appendix:  A. Interviews with Key Constituent Groups:

College of Science
Active Learning in the College of Science

There is an overall demand for shrinking the sizes of large enrollment courses to enable more active teaching methods, such as flipped courses, online-F2F hybrid mix, and smaller sections. Many of the college’s large enrollment courses are “service courses” that students take to fulfill requirements from other colleges. Consequently, departments within the college structure many of these courses to maximize efficiency and to ensure that there are enough sections and spots within them available to students. In addition to lectures, faculty who teach lab sessions wish to have better labs that allow for greater flexibility and demonstrations. Live demonstrations are also an important component of large lecture courses, which requires lab prep areas in close proximity to lecture spaces. The College of Science is supporting the development of online course material to supplement lecture courses and to enable more flexible use of class time. Individual departments continue to explore the extent of their respective investments in such endeavors.

Barriers to Active Learning

Despite an expressed interest in redesigning courses, several barriers were discussed that inhibit change. These barriers are:

• Lack of available classroom space
• Lack of flexible classroom space
• Requisite amount of time to invest in instructional design
• Manpower and the ability to manage multiple class sections and activities
**Interviews with Key Constituent Groups**

**College of Science**

**Instructional Development Partnerships**

Faculty in the College of Science recognize that partnering with other campus groups is a way to strengthen the redesign of courses. Instructional design support can enable faculty to create course material better and faster. Although it was suggested that many faculty are capable of developing new course material and integrating innovative content into their courses, instructional design experts would be much faster at doing so and would have access to better content. It was emphasized that effective instructional design support from experts in ITaP, the libraries, and CIE must possess a strong balance of content matter expertise and instructional design methods in order to effectively partner with faculty.

**Demand for Active Learning Spaces**

Several desired features of formal and informal learning spaces were discussed.

- Access to computing technologies
- Cameras that broadcast demonstrations
- Demonstration stations and prep rooms
- Modular equipment storage in preparation areas
- Informal study areas similar to the configuration in the newly renovated Parrish Library space
College of Science
Large Enrollment Courses | Biology

<table>
<thead>
<tr>
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<th>Fall 2010</th>
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<th>Fall 2011</th>
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<td>BIOL 111</td>
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<th>Recitation Sections</th>
<th>Lab Sections</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 110</td>
<td>• 455 students (3 sections)</td>
<td>• 30 students (50 sections)</td>
<td>• 30 students (50 sections)</td>
</tr>
<tr>
<td></td>
<td>• Flipped lecture sessions</td>
<td>• Students work on standard problem sets</td>
<td>• Students work in groups of 3-4 on problems that build on lecture material</td>
</tr>
<tr>
<td></td>
<td>• Instructor lectures for no more than 30 minutes per session</td>
<td></td>
<td></td>
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</table>
Supplemental Instruction
- SI has recently been integrated into BIOL 110.
- Drop-in sessions are offered twice per week.

Technology
- The instructor uses clicker response tools during lecture.
- Hot Seat (not the live version) is used and is synced with students’ Facebook and Twitter feeds.
- The use of a document camera to share notes would enhance the lecture sessions.

Library
- Information literacy (evaluation of scientific research) is an increasingly important aspect of introductory biology courses and an increasingly desirable skill for students to master as it aligns with critical thinking.
Interviews with Key Constituent Groups

A College of Science
Large Enrollment Courses | Biology

Demands for Classroom Space

• BIOL 110 currently uses a flipped class format in which lecture is minimized to no more than 30 minutes per session. Students are currently working on problems in small groups during lecture sessions. An ideal active learning lecture space would allow the instructor to easily wander among groups of students.

• An ideal lecture size is unknown, as the instructor is currently comfortable teaching to large groups – despite the current limitations of lecture hall design.

• Students in recitation sections currently work in groups of 3-4.

• The instructor would like to design a better lab experience that allows for more flexibility in allowing students to design their own problems. The current format is constrained by “cookie cutter” problems that don’t adequately engage the variety of students’ interests.

Demands for Non-Classroom Space

• The instructor expressed a demand for a dedicated i2i space for biology

Factors that Constrain the Adoption of Active Learning

• Financial and manpower constraints currently limit the number of additional sections that the college can offer.

• Active learning is currently a core aspect of BIOL 110. The size of lecture sections is currently constrained by the capacity of the lecture halls. The current layout lecture halls do not fully support active learning principles in that they limit the instructor’s ability to easily move around the room and interact with student groups.
## Interviews with Key Constituent Groups

### College of Science

#### Large Enrollment Courses | Chemistry

<table>
<thead>
<tr>
<th>Enrollment</th>
<th>Fall 2010</th>
<th>Spring 2011</th>
<th>Fall 2011</th>
<th>Spring 2012</th>
</tr>
</thead>
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<tr>
<td>CHEM 115</td>
<td>2,092</td>
<td>597</td>
<td>2,217</td>
<td>648</td>
</tr>
<tr>
<td>CHEM 116</td>
<td>444</td>
<td>1,155</td>
<td>497</td>
<td>1,206</td>
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<tr>
<th>Structure</th>
<th>Lecture Sections</th>
<th>Recitation Sections</th>
<th>Lab Sections</th>
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<tbody>
<tr>
<td>CHEM 115</td>
<td>~300 students/section</td>
<td>24 students/section</td>
<td>24 students/section</td>
</tr>
<tr>
<td></td>
<td>~300 students/section</td>
<td>1 graduate TA</td>
<td>1 graduate TA</td>
</tr>
<tr>
<td></td>
<td>~300 students/section</td>
<td>1 recitation/week</td>
<td>1 lab/week</td>
</tr>
<tr>
<td>CHEM 116</td>
<td>~300 students/section</td>
<td>24 students/section</td>
<td>24 students/section</td>
</tr>
<tr>
<td></td>
<td>~300 students/section</td>
<td>1 graduate TA</td>
<td>1 graduate TA</td>
</tr>
<tr>
<td></td>
<td>~300 students/section</td>
<td>1 recitation/week</td>
<td>1 lab/week</td>
</tr>
</tbody>
</table>
Technology
- Clickers
- Videos
- Smart pens
- Document camera & projection
- Lectures are recorded and archived online
- Virtual homework is entered and graded online using McGraw-Hill homework package

Library
Information literacy requirements are not currently part of the CHEM 115/116 course sequence
Demands for Classroom Space

- Instead of conducting two lecture periods per week, online lecture sessions viewed in advance of class could enable time for more active in-class problem-solving sessions.
- Chemistry instructors incorporate video demonstrations of chemical reactions into lecture sessions. Some chemistry lecture rooms are adjacent to chemical prep labs where live demonstrations can be prepared before class. Live demonstrations are popular with students. Active learning classrooms for chemistry classes should continue to support live demonstrations.
- Active learning classrooms could be designed to allow groups of students to collaborate on challenging problem-based exercises that necessitate higher levels of interaction. “Buffer problems” and “what-went-wrong” problems characterize the nature of exercises in chemistry courses. White boards are an effective means for catalyzing group discussion and problem solving.

Factors that Constrain the Adoption of Active Learning

- Enrollment in large science courses is driven by the availability of labs (which can accommodate 20 students each). The number of available labs limits the number of sections that can be offered in a course. Smaller lecture formats would increase the number of course sections, which would increase the demand for lab space.
- The lack of manpower resources (i.e. the availability of faculty and teaching assistants) constrains the ability to plan more active courses.
Interviews with Key Constituent Groups

**College of Science**
Large Enrollment Courses | Mathematics

<table>
<thead>
<tr>
<th>Enrollment</th>
<th>Fall 2010</th>
<th>Spring 2011</th>
<th>Fall 2011</th>
<th>Spring 2012</th>
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<td>MA 153</td>
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<td>451</td>
<td>1,375</td>
<td>436</td>
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<td>990</td>
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</table>

<table>
<thead>
<tr>
<th>Structure</th>
<th>Lecture Sections</th>
<th>Recitation Sections</th>
</tr>
</thead>
</table>
| MA 153    | • 35 students/section if led by a TA  
            • 120 students/section if led by a faculty member | No Recitation |
| MA 161    | Large lecture format | • 35-38 students/section, twice per week  
            • Sessions are structured to address students’ questions about homework assignments |
| MA 165    | Large lecture format | • 35-38 students/section, once per week  
            • Sessions are structured to address students’ questions about homework assignments |
Interviews with Key Constituent Groups

A

**College of Science**

Large Enrollment Courses | Mathematics

**Supplemental Instruction**
- Operates on a drop-in basis to support students as needed
- SI can accommodate up to 30 students, but attendance is usually lower

**Technology**
- Students access and submit homework solutions through online format
- Online homework software includes a time stamp feature, which could provide some insight into the amount of time students spend engaged in homework assignments
Interviews with Key Constituent Groups

A College of Science
Large Enrollment Courses | Mathematics

Demand for Classroom Space

- The class format would support the delivery of online lectures that students could view before coming to class.
- Online lecture delivery would enable the use of more active teaching methods. Classes could be designed to accommodate discussions of theory at the beginning of the class period, which would allow for more time to be spent on working through problems in an active format.
- The ideal size for active learning groups in math courses is 6-8 students per group.

Demand for Non-Classroom Space

- Students often collaboratively work in small groups on homework problems.

Factors that Constrain the Adoption of Active Learning

- Because of the sequential nature of math courses, changes that are made to one course in a sequence would have to be made across other courses in the sequence.
- The lack of financial resources for the hiring of TA’s and the lack of available classroom space constrains the possible redesign of the course into smaller sections.
Changes in Course Delivery

“The College of Technology has a new core (three courses) that it is in the process of rolling out. TECH 120, the first of this, was offered last year as four, large section lecture only courses; it was less than successful due to the constraints associated with sections of 150 or more. As such we are revamping the course through the IMPACT program over the summer (doing a flip course). Two additional courses will be offered as part of the core and likely we will consider non-traditional pedagogical techniques in those courses given what we have learned in TECH 120. Each department also offers a gateway course. We are looking at ways to change the way we have done things with those courses as well (although adoption of revised thinking is somewhat limited).”

I expect that course delivery in 10 years will be more asynchronous, more active learning, more service learning oriented and less Greek lecture-style. It will be problem solving based...Still of importance to us will be theory and practice, interaction (teacher-student and student-student).”

“We are rethinking how we deliver courses, but change (or changing the minds of faculty in the ways they approach instruction) is slow.”
A College of Technology

Spatial Implications

“As of fall 2012, there will be three large classes taught using the IMPACT model: TECH 120, CGT (Instructor: Miller) and MET (French).”

“I believe that the university should continue to grow the number of spaces like the Parrish Library in Krannert (active learning spaces). But as we grow the spaces we need to continue efforts that transform how instructors use those spaces. This is a cyclical process – as more faculty/courses are transformed, more and more spaces will be needed. But we cannot grow the need for space without growing the course/instructor transformation.”

“I am not sure how to estimate this [change in course delivery over the next 10 years]. In the COT, I am not sure we will ever get totally away from the lab concept. It is core of who we are and what we do. However, the revolution will be in the ‘lecture’ and ‘demonstration’ parts of what we do. More and more of that can be put online or taught in more effective ways than the traditional lecture setting.”
College of Technology

Hybrid Teaching Mix
“In our undergraduate programs, the amount of this [hybrid class mix] is relatively small. I would guess 5%, but it is only that...I believe in 10 years we will grow to 75 percent or more...I believe this transition should allow for smaller more interactive/creative spaces.”

Demand for Informal Learning Spaces

“Within our building, there are not a lot of spaces for collaboration or study. There are a few congregational area (that are heavily used during the academic semester) but nothing on the order of Parrish Library. I need to make it known that the Dean of Technology has stated that he is willing to have conversation(s) about how the CoT (in Knoy) might transform or create a space like Parrish Library...I believe more and more is going to be needed as we do more service and project-based learning.”
Appendix: A. Interviews with Key Constituent Groups:
College of Veterinary Medicine
Interviews with Key Constituent Groups

A College of Veterinary Medicine

Active Learning in the College of Veterinary Medicine

The College of Veterinary Medicine only offers one undergraduate program – veterinary technician (associate’s degree) or veterinary technologist (bachelor’s degree). It is a small enrollment program, as most students in the college are professional students enrolled in the DVM program. There largest enrollment undergraduate course in the college is 120 students (4 sections of 30 students each). Veterinary medicine students typically take courses in a lock step sequence. Changes to course structure or pedagogical method would necessitate a full review for its impact throughout the curriculum. Changes must also remain consistent with professional accreditation standards. To facilitate student access to instructional materials, the college will require – in the fall of 2013 – that all veterinary medical students have a laptop.

Information literacy is becoming an increasingly important component to the veterinary curriculum. The voluminous amount of information on animal and pet care results in a lot of public misinformation that students must be able to identify and to which they will need to respond as members of the professional veterinary medical community.
College of Veterinary Medicine

Barriers to Active Learning
In addition to the constraints associated with the lock-step curriculum, the college currently has a dearth of space that inhibits major changes to new teaching/learning methods. The culture of veterinary medicine is more aligned with didactic teaching/learning methods than it is with active methods. Furthermore, many faculty are full time clinicians, which does not allow for sufficient time to invest in course redesign.

Demand for Active Learning Spaces
Veterinary Medicine students are mostly confined to their college’s campus buildings, which are isolated from many other campus facilities. Students typically use the space on a 8-5 schedule. There is not much downtime in students’ schedules, and there are few places for them to go outside of Lynn Hall. The veterinary library and student lounge are fairly small spaces that do not support the “hallway conversations” that are instrumental to students’ routines.

Discussions with college leaders indicated that a space similar to the new Parrish Library space in Krannert (with dividable rooms and flexible furniture) would greatly support the goals of the college. Such space would have to provide additional storage areas for students to keep their belongings throughout the day.
Changes in Course Delivery

“We have already incorporated small group problem-based learning into our DVM curriculum and there are many hands-on learning activities in both the veterinary technology and veterinary medicine curricula. We do not foresee major changes in course delivery in the veterinary medicine and veterinary technology curricula in the next 10 years. We expect our curricula to remain strongly lecture-based because of the large amount of technical information that must be taught. We expect to see increased utilization of online materials but that will not take the place of most classroom-based teaching. We would like to see an increase in active learning in the classroom but lecture is expected to remain an important mode of delivery.”

Spatial Implications

“We are currently renovating one of our lecture rooms into a flexible teaching space that will allow small group teaching with data connections and the ability to project work for each group. This room is likely to be used for lecture a large percentage of the time...We don’t foresee major changes in the proportion of time spent with each type of teaching although we need additional space for the students to do collaborative learning and individual and small group study in a comfortable atmosphere.”
College of Veterinary Medicine

Hybrid Teaching Mix

“I cannot anticipate what percentage of courses will be hybrid. A rough guess is 20% but that depends on how open the faculty become to teaching in different manners...I don’t think the change will be large enough to impact classroom scheduling.”

Informal Learning Space

“We have a great need for informal learning space that is flexible. We need comfortable, well-lit space with natural light in which students can study individually and in small groups. There needs to be access to food and drink. A place similar to the Krannert Library would be ideal. Our curricula already incorporate many group projects and there are not sufficient spaces in which the students can get together and work. It would be particularly helpful for small group study areas to have the ability to project from a laptop computer and to have smart boards from which students can save their work.”
Environmental Scan: Trends in Pedagogy at Other Universities
An active learning working group at UC Berkeley recently (2010) completed an internal report that reflected an assessment of the current and future state of active learning pedagogies. The working group explored the extent to which the university should invest in new classroom space to support active learning. The working group found that all of the faculty members interviewed were interested in more flexible classrooms that would allow increased group activities and instructor mobility.

The working group’s recommended a series of steps for introducing active learning classrooms into the university’s Moffitt Library:

• Build an active learning classroom that can seat 100+ students
• Improve one of the large lecture halls in Moffitt, maintaining a seating capacity of 80+
• Create an informal learning space in Moffitt near the classrooms
• Develop an incentive program for departments to create informal learning spaces in departmentally controlled areas
• Develop other active learning spaces on campus when possible and, when refitting any classrooms, use flexible furnishings that can accommodate group activities
• Offer instructional design support to faculty interested in adapting courses to active learning settings.
Campus-Wide Assessment of Learning Space
Virginia Tech

Virginia Tech evaluated its 168 general assignment classrooms and found that the spaces were stressed and unable to flexibly accommodate changing pedagogical methods. Recognizing these limitations, the university commenced an internal stakeholder analysis and needs assessment for exploring a future direction for change.

Key findings and recommendations:
• Create pilot spaces where new teaching and learning methods can be explored and evaluated
• Provide more flexible and easily reconfigurable seating arrangements in spaces by increasing the number of moveable tables and chairs
• Provide break out spaces for small groups (~6 students) in close proximity to classrooms that include projection technologies that support collaborative activity
• Reduce the total number of classroom seats from 11,222 to 6,109 through reduction of overall seating capacity in crowded classrooms (-1810); safety code conformity (-237); and utilization reduction (-3,086)
• Employ consistent technology standards across all classrooms to support ease-of-use and reduced class set-up times
Planning for a New Classroom Building

Virginia Tech is in the process of planning a new classroom building containing approximately 75,000 square feet of space, and administrators convened a planning committee to determine the building’s design. To evaluate the classroom types the building should contain, members of the group:

• Conducted a review of existing classrooms, considering existing room capacities, flexibility, furniture, and ability to support problem-based, active, and collaborative learning
• Surveyed faculty to identify what composes ideal instructional spaces for large and small course sections
• Met with representatives of each academic department individually to discuss emerging pedagogies and their impact on classroom space

The new classroom building is being developed through input from Undergraduate Education, the Provost’s Office, the university’s three largest colleges, the Registrar, the University Architect, Facilities, Classroom Technology, and the Faculty Development Institute

Demand for Larger Active Learning Spaces

Several university officials indicate a need for modified SCALE-UP classrooms with larger seat capacities to accommodate courses with larger enrollments. Administrators at Virginia Tech are exploring workable configurations for course sections of 120 or 150 students. Pod sizes will reportedly diverge from SCALE-UP’s nine at each circular table to, perhaps, four or eight students at each X-shaped table. This adaptation may allow Virginia Tech to accommodate more instructors’ teaching styles, as well as increase space usage.

The University Leadership Council. The Impact of Pedagogical and Technological Innovation on Space Planning. Custom Research Brief Prepared for Purdue University by the Education Advisory Board.
In 2008-09 the University of Illinois (UI) commissioned an internal study to evaluate the results of a classroom space audit. Under the direction of the Provost, the Instructional Space Implementation Team (ISIT) addressed challenges and opportunities surrounding new instructional technologies and learning spaces needs that the university expected to face. After conducting a series of internal town hall meeting the ISIT listed several key findings about the demand for new learning spaces.

**Among the findings:**

- Inventory of classroom space in the size range of ~75-125 seats does not meet the current demand.
- Only 25% of the general purpose classrooms are equipped with IT and this situation does not meet the current demand. Resources are needed to move us into outfitting more classrooms with technology.
- Many departments noted that the ability to increase enrollment in courses has been restricted due to the lack of availability of larger instructional space.
- The poor condition of classrooms was mentioned in numerous meetings.

Despite ISIT’s findings indicating the multiple drawbacks to the availability and condition of campus learning spaces, ISIT included a bibliography of multiple active learning and SCALE-UP resources. The report indicated ISIT’s interest in further exploring possibilities for integrating better classroom designs to accommodate active learning methods.
The University of Minnesota has a centralized classroom management and space utilization service that operates from a “one-stop-shop” principle. The Office of Classroom Management (OCM) is the central point of contact, and primary point of responsibility, for all general-purpose classrooms on the UMN Twin Cities campus. OCM partners with individual academic units and has employed key planning principles for supporting pedagogical shifts toward active learning.

**Metrics based classroom planning – key principles:**
- Fewer classrooms that are of higher quality and better utilized
- Flexibility is prioritized in the planning and design of new classroom buildings
- Smaller, flexible, and projection capable classrooms that can accommodate continuously shifting teaching and learning methods
- Information technology and projection systems are standardized across spaces to support ease-of-use and reduced class set-up times
- The university piloted two “flex forward” and “flex down” SCALE-UP classrooms. Classroom #1 had a SCALE-UP capacity of 45. Classroom #2 had a capacity of 117 that could be flexed down to two rooms of 72 and 45.
Active Learning in Large Enrollment Courses
University of Alabama

As part of its Quality Enhancement Plan (2005-06), the university identified “active and collaborative learning” as a key focus area for addressing undergraduate education, particularly for first and second-year students. UA initially focused its efforts on making large lecture-format courses more active, but interest in methods to support active learning began to spread among faculty teaching other courses. Active learning is now a university-wide focus. Faculty can apply for course redevelopment funding through the Office of the Provost.

Example of a redesign of a 200-level large enrollment sociology course

- Hybrid course – mix of face-to-face, in-class meetings with online delivery of some course materials
- Homework assignments conducted and submitted electronically
- Class met once-per-week for 75 minutes
- 114 students – divided into 12 groups – team roles within each group rotated each week
- Group discussions were held after each group completed the week’s in-class work
- The design of this course helped promote both speaking (for the social construction of knowledge) and writing (for the personal construction of knowledge)

Key pedagogical practices:
- Lecture was eliminated as the primary mode of instruction
- The group discussion (whether conducted in person or online) was introduced as a vehicle for peer education, collaborative learning, critical thinking, and active problem solving
- Assignments were designed to promote active problem solving
- A variety of assessments were used

Active Learning in Large Enrollment Courses
University of Maryland-Baltimore County

In addressing the needs of large enrollment first year chemistry courses, faculty at UMBC adopted new active learning methods that placed new expectations for individual and group learning outcomes on students. The successes generated from the redesign of the UMBC chemistry course curriculum and learning spaces have catalyzed similar changes across campus toward a broader embrace of active learning methods and flexible learning spaces. Consequently, UMBC is planning for a new interdisciplinary life sciences building, which will consist of a suite of flexible and reconfigurable active learning spaces.

Principles of the redesigned recitation sessions for first-year chemistry classes
• Students sit in groups of 4. There are 18 groups per class. A facilitator oversees each table during the class session.
• Students in each group are assigned 1 of 4 roles: Manager/Spokesperson, Blogger, Whiteboard Scribe, and Researcher/Investigator. Roles are initially assigned at random and subsequently rotated on a weekly basis. Team members evaluate one another’s performance in their respective roles.
• The class went completely paperless – all documents were electronic and people were encouraged to work together.
• $85,000 retrofit to an old room – white boards, big screen TV’s, computers, dividers (tables were set up as triads)
• No head table in the classroom
Active Learning in Large Enrollment Courses

Large Accounting Course at a University in Belgium

General course characteristics
- Enrollment of 500; Tutorial sections of 100-150 students
- In the traditional lecture format, students were postponing practice until the end of the semester and struggling to pass the course

Characteristics of the active learning accounting class (experimental group)
- Self-selected clustering of students into groups of 5
- Team leader role was assigned for each group, and the responsibility was rotated weekly
- Mandatory group learning exercises to be prepared before class
- Students were asked to report their preparation, work time, and attendance within their groups
- Instructors designed the learning tasks, monitored the functioning of groups, and provided feedback as needed

Results
- Team learners would be more satisfied compared to students who attended the traditional lecture-based approach.
- When assessed, student satisfaction was higher and perceived good teaching was found to be significantly higher in the team learning compared to the lecture-based condition
- However, some students felt that the online material made the class session redundant.
- The active learning course was conducted in a traditional lecture hall, and some students reported that the space did not adequately support the experience

Overview of U-M’s North Quad Living-Learning Community
The University of Michigan (U-M) dedicated its North Quadrangle Residential and Academic Complex (North Quad) in 2010. North Quad is a 360,000 square foot complex that incorporates a mix of public and private spaces to promote active learning across a range of activities. The space is divided into two wings – residential and non-residential space. The non-residential space mix includes academic offices, classrooms, and other informal collaborative spaces. A program manager is responsible for ensuring collaboration among the departments in the space and for orchestrating collaborative events and activities. North Quad is adjacent to the university’s central campus and is embedded within Ann Arbor’s the State Street commercial district.

North Quad Space Mix:
- Ehrlicher Room – multi-purpose lecture and presentation space for the U-M School of Information
- 19 centrally controlled university classrooms (small classrooms and tiered lecture spaces)
- Small team rooms that can be reserved for group study
- Residences and residential commons areas
- “Space 2435” is an active space that can be reserved and configured for a variety of uses including lectures, workshops, design jams, poster sessions, and other group activities
- Media Gateway informal spaces support collaboration and small gatherings in an informal, lounge-style setting
- Language Resource Center
- Sweetland Writing Center
- Departmental library for the Department of Screen Arts & Cultures
- Global Scholars Program
- Department of Communication Studies
Active Learning Classrooms
University of Michigan

User Patterns – North Quad Space 2435
Space 2435 is a 24/7-accessible space that can be reserved for events, but users cannot schedule classes in the space. The room can be divided into five smaller spaces. The space is available for ad-hoc use when it is not scheduled. Feedback suggests that users are unsure of how to use the space. Although it was designed for events and more active activities, users typically reserve the space for formal meetings. The space is typically reserved as a whole rather than in separate sections – in part because the scheduling system does not easily accommodate the scheduling of sections. Because many of the scheduling meeting are conducted behind closed doors, the space gives the impression to would-be ad-hoc users that it is off limits to them.

User Patterns – North Quad Media Gateway
The Media Gateway was designed as a 24/7-accessible space to encourage collaboration and the display of user content as well as to promote wider multi-media literacy. Some informal events are held in the space, but the space is intended for ad-hoc interaction. Additionally there are small group meeting rooms adjacent to the Media Gateways' main open area. The Media Gateway is equipped with 46” LCD monitors to which users can connect. According to feedback from the North Quad’s IT support team, the monitors are not heavily used. Users have demonstrated a preference for sharing content in the small adjacent meeting rooms rather than doing so on the 46” monitors in the open area. It has been noted that students prefer to use the Media Gateway more as a quiet study space and that some students feel reluctant to share content in such a visible way in a public space. Future enhancements to the space may include walk-up video conferencing technologies.
Active Learning Classrooms
University of Minnesota

Overview of Active Learning Classrooms at UMN ¹
- UMN’s active learning classrooms are based on the SCALE-UP concept, and they utilize an adaptation of the Projection Capable Classrooms (PCC) technology system. Active learning classrooms feature
  - 360-degree glass-surface marker board
  - Multiple flat-panel display projection systems
  - Round tables that accommodate nine students each
  - Centered teaching station that allows selection and display of table-specific information

Fourteen active learning classrooms are available in the university’s Science Teaching & Student Services Building (STSS), and are available for anyone to request during open scheduling. These classrooms accommodate between 27 and 126 individuals, and are able to flex into larger classrooms based on semester-to-semester demand.

Students Demand for Active Learning Spaces ²
One-third of the university’s 30,000 undergraduates took a class in an active learning classroom in the first year the building was open. Greater than 40 percent of undergraduates took a course in the STSS building and so had at least indirect exposure to the active learning classrooms. First and second year students typically indicate desire for additional courses in active learning classrooms and some become advocates for additional active learning spaces. Third and fourth year students were reportedly less enthusiastic because they had a more difficult time transitioning from the traditional classroom environments they began their college careers in.

¹ [http://www.classroom.umn.edu/projects/ALCOverview.html](http://www.classroom.umn.edu/projects/ALCOverview.html)
² The University Leadership Council. The Impact of Pedagogical and Technological Innovation on Space Planning. Custom Research Brief Prepared for Purdue University by the Education Advisory Board.
**Active Learning Classrooms**

University of Minnesota

**Allocating Classroom Space in the Science, Teaching & Student Services (STSS) Building**

UMN Administrators began planning the combination of classes for the Science Teaching and Student Services (STSS) building by:

- Reviewing the general classroom inventory.
- Conducting conversations with representatives from each college, requesting two and five year enrollment forecasts for each major.
- Tested various space scenarios with planning software, taking into account each college’s demand for active learning classrooms.

Additionally, the STSS building replaced an older building with four large science demonstration lecture halls, so administrators negotiated with science departments to reduce the number of large lecture halls to two. However, the lecture halls’ structure retains flexibility for future use. University of Minnesota administrators can convert the lecture halls into additional active learning classrooms at significantly less expense than in a typical building.

The University Leadership Council. *The Impact of Pedagogical and Technological Innovation on Space Planning*. Custom Research Brief Prepared for Purdue University by the Education Advisory Board.

© DEGW 2012 | An analysis of the impact in pedagogy and study needs on planning of future classroom and study facilities | 93
Overview of the university’s Rooms for Engaged and Active Learning (REAL) initiative

MSU’s University Classroom Committee has spearheaded an effort to adopt innovative classroom designs to facilitate engaged and active learning. The university is referring to these as Rooms for Engaged and Active Learning (REAL). REAL is based on the SCALE-UP approach to classroom design. MSU will complete construction of two REAL spaces that will be available for use in spring 2013. Design features include:

- Instructor station
- Four flat panel displays around the room
- Dual flat panel displays at each table
- Whiteboards around the room for each table
- Spaces will feature 10 semi-circular tables and will be able to accommodate 60 students

(http://tech.msu.edu/classroom-technology/real.php)
Overview the Wisconsin Collaboratory for Enhanced Learning (WisCEL)
WisCEL (pronounced “whistle”) debuted in early 2012 in renovated spaces at the College Library (the undergraduate library) and Wendt Commons Library (engineering library). The spaces support students in a variety of informal collaborative learning activities. WisCEL is a hub for active learning where faculty can submit applications to use the space to support redesigned courses. It also provides students with a hub for academic support. WisCEL houses tutors and teaching assistants, and it provides students software that provides immediate feedback on homework.

Features of WisCEL spaces:
• Circular tables that seat groups of 6
• Tables equipped with laptops and television monitors that allow students to display documents
• Enclosed active learning classrooms
• Small group meeting areas supported by a variety of seating configurations

Courses offered at WisCEL in spring 2012:
• College Library offered three intro math courses – Math 95, 101 and 112
• Wendt Commons offered statics and circuit analysis (traditional "weed-out" courses)
Summary of “Flipped” Classes at Penn State

- Jinger Gottschall (KINES 360) assesses student understanding of materials presented in the previous class with a closed book quiz, which students take using clickers. To engage students further they are assigned the task of creating some of the quiz questions.
- Dirk Mateer (ECON 102) uses lecture capture and group video projects to explain economic concepts, which are then used as reference videos for future classes.
- Kenneth Pasch (ACCTG 211) lets his 1,300 students choose how much they want to interact in the course, from totally online to several combinations of online and face-to-face formats. Class time consists of video interviews about real-world application of accounting scenarios, and labs, explanatory homework videos, and podcasts of his lectures enhanced with slides and screen captures.
- Greg Pierce (FIN 100) creates videos of himself as instructor working through example problems beyond the assigned homework as supplemental materials for students to review on iTunesU.
- Sam Richards (SOC 119) uses blogs and video to enhance a large class format, and lectures only once a week; the other two class periods are used for small group meetings.
- Jenny Shook (STAT 200, 250) uses lecture capture software to create short videos demonstrating the concepts that will be used in class. She provides paper quizzes at the start of class to gauge understanding.

(http://tlt.its.psu.edu/flip/)
Active Learning Trends
Penn State University

Use of tablet PC’s in electrical engineering courses – Project abstract (2008-09):
“The main objective of this project is to move toward a full integration of active learning with tablet PCs into an Electrical Engineering (EE) degree program. In order to achieve this goal, students are allowed to borrow tablet PCs for the entire semester time. In addition, the HP mobile technology is used to design, create, and implement a continuum of courses integrating active learning into our EE program. By gradually adding more courses into the project, students and faculty members will experience a seamless and unison implementation of active learning environment in most of the courses in our program.”

(http://hbg.psu.edu/ee-eet/09%20HP Poster_PennStateHBG.pdf)

Architects, Space Planners, IT Staff Drive Learning Space Design

Architects, physical plant administrators, and IT personnel currently determine classroom design, not faculty members or pedagogical experts. However, Penn State’s provost recently charged a study group to consider how pedagogical and technological changes impact how institution community members use formal academic space. Some Penn State faculty hope this study group will lead to greater faculty and pedagogical influence on classroom design.

The University Leadership Council. The Impact of Pedagogical and Technological Innovation on Space Planning. Custom Research Brief Prepared for Purdue University by the Education Advisory Board.
Research Study Findings
Interdisciplinary Education

Best Practices for Interdisciplinary Education
According to a list published by the Association for the Study of Higher Education (ASHE)\(^1\), interdisciplinary education is best supported by collaborative and more active forms of learning. Additionally, the importance of learning space was underscored as a variable that supports interdisciplinary education:

- Dedicated organizational and physical space
- Dedicated space provides visibility to programs and legitimizes their activities
- “The integration of laboratory and lecture spaces in science, engineering, and mathematics fields, for example, cultivates a flexible environment that fosters innovative pedagogy” (p. 92)
- Focus on collaborative learning rather than mastery of a particular content”
- Student responsibility for engaging in learning activities
- Students teaching one another and relying less on instructors (peer mentorship and peer instruction)

Research Study Findings

Design of Core Courses

Five Features of Effective Core Courses
The following list describes how active learning methods enhance the design of foundational undergraduate courses:

Creating community through collaborative learning
- Involves strengthening the rapport among students and faculty
- Adapting courses to student needs
- Creating an environment to support different learning styles

Fostering student ownership of learning
- Incorporating student input into building the syllabus
- Faculty passion for teaching their subject matter

Connecting academic ideas with other disciplines and with the real world
- Incorporating out-of-classroom and off-campus experiences into courses

Evaluating student learning through active experiences
- Faculty asked students to demonstrate their subject matter grasp through writing, creative projects, and presentations

Sharing the experience of the discipline
- Shift from rote memorization to active participation in subject matter debates and discussions of theory

Research Study Findings

Faculty-Student Interaction

More Relaxed Faculty-Student Interaction

One study of active learning communities showed how interaction between students and faculty relaxes. “Although many students enrolled in FLCs because of interest in the topic of the content course, most hoped to improve their academic skills, especially writing. The focus group data suggest that classroom milieu played a strong role in student learning. The students who felt they improved their writing or study skills also had positive FLC classroom interactions with the instructor and their peers. They felt at ease speaking up in class, perceived their instructors as caring and approachable, and enjoyed sociability with their peers.”

In a research study of redesigned STEM classes at three universities, faculty-student interactions were found to have loosened and become more informal. “These interactions with faculty went beyond the usual kind of consulting that occurs for most students immediately before or after class sessions; they more closely resembled relaxed conversational interaction focused on the students’ research projects. Although such interactions are important in establishing students’ academic integration in college, research tells us that increasingly, students are unlikely to have such interactions with faculty. Because these faculty were not occupied at the front of the room for the entire class period, they had time to pay attention to individuals and small groups.”


NCAT has 11 years experience in conducting large-scale, grant funded redesign projects integrating technology. Their grants for math course redesigns have involved 37 institutions (as of June 2011), and they maintain a database of compiled results.

Course redesigns have increased percentage of students successfully completing a college-level math course by 25 percent on average (from 7 to 63 percent) while reducing the cost of instruction by 37 percent on average (from 15 to 77 percent).

Why the “Emporium Model” for math is so successful:
- Students spend the bulk of their time doing math problems rather than listening to someone talk about doing them.
- Students spend more time on things they don’t understand and less time on things they have already mastered.
- Students get assistance when they encounter problems, with instant feedback, and on-demand personalized assistance.
- Students are required to do math, requiring participation.

NCAT Four Stages of Innovation
Stage I: Experimentation
Stage II: Modification
Stage III: Replication
Stage IV: Expansion
National Course Redesign Initiatives
National Center for Academic Transformation (NCAT)

NCAT Six Models for Course Redesign
Supplemental: add to current structure and/or change the content
Replacement: blend face-to-face with online activities
Emporium: move all classes to a lab setting
Fully Online: conduct all (or most) learning activities online
Buffet: mix and match according to student preferences
Linked Workshops: replace developmental courses with just-in-time workshops

Five Principles of Successful Course Redesign
Redesign the whole course.
Encourage active learning.
Provide students with individualized assistance.
Build in ongoing assessment and prompt (automated) feedback.
Ensure sufficient time on task and monitor student progress.
C

Environmental Scan:
New Learning Facilities at Other Universities
New Learning Facilities at Other Universities

**North Carolina State University**

**SCALE-UP**

- Primary goal of the SCALE-UP Project (Student-Centered Activities for Large Enrollment Undergraduate Programs) is to establish a highly collaborative, hands-on, computer-rich, interactive learning environment for large-enrollment courses.

- Developed originally at NCSU by Bob Beichner for teaching physics, the space model has been adopted by other engineering schools, e.g. MIT’s TEAL spaces.

- Promotes active learning in a redesigned classroom of 100 students or more, with potential to radically change the way large classes are taught by supporting more active learning.

- Students work in three teams of three at 7’ round tables on hands-on activities while instructors and TAs circulate.

- The SCALE-UP website has over 10 years of data on similar installations and documentation of their successes

(Source: SCALE-UP)
New Learning Facilities at Other Universities

University of Minnesota
New Science Teaching and Student Services Building

- After a program to test 2 active learning spaces over a two year period, UM has built a new 115,000 sf classroom building, with 1,639 seats in a total of 17 classrooms
- 10 active learning classrooms with round tables, switchable laptop-based technology, fixed flat panel displays, and marker board around the perimeter, which provide for technology-driven and collaborative interaction among students and faculty.
- 5 multipurpose classrooms and two large lecture halls
- Lounges on each floor
- One Stop Service Center, including: Center for Academic Planning & Exploration, Career Services Center, Interview Center, One Stop Student Services - East Bank, Student Account Assistance, Student Engagement, and Office for University Veterans Services

(Source: U. Minnesota. Kohn Pedersen Fox Assoc. in association with Hammel, Green and Abrahamson Inc., Architects)
University of Massachusetts-Amherst
Du Bois Library Master Plan

- As part of a master plan for the Libraries, the Du Bois Library tower was examined for opportunities to repurpose space for new functions aligned with the university’s future needs and desire to encourage development of team based learning. The Library has been aggressive about developing partnerships to support the learning process and welcoming partners into the library space.

- The successful Learning Commons at the base is proposed to be expanded, converting space to more study area plus two new active learning classrooms with round tables. One was occupied in 2011 as a pilot for testing.

- Future phased renovation will dedicate the 2nd floor to experimental learning studios and a media hub. OIT classrooms for technology-enabled teaching will be immediately above. Other classrooms are ones the library schedules for information literacy classes and the Learning Resource Center uses for peer tutoring sessions.

- The Teaching Commons supports faculty in teaching and curriculum development.

The library manages the building and is open close to 24/7. Students recognize it as a comfortable safe haven when working late at night and it has become a vibrant center for informal learning at the heart of the campus. (Source: DEGW)
In order to accommodate projected growth in its student population, UMass Amherst is building a new Academic Classroom Building adjacent to the central pond. The 172,000 gsf building is now in construction, due to open in Spring 2014 and budgeted at $85 million.

Half the building will be a range of different types and sizes of teaching spaces, including a 350 seat auditorium, 2 tiered lecture halls, 3 case rooms, 5 flexible classrooms, and 5 team based learning (TBL) rooms. The rest of the building will house needed academic departmental space.

The TBL rooms will range in capacity from 63 to 99 seats, using the SCALE-UP model of round tables with 9 seats each.

Informal learning settings will be integrated as a lounge on the first floor along one façade and distributed pockets of informal seating near the classroom zones.

It is hoped that the additional classroom capacity will then enable conversion of more existing teaching spaces to improved or TBL settings.
OE Oregon State University
Proposed Classroom Building

• OSU is planning a new 120,000 sf state of the art classroom building in the heart of the campus. The building will define a new quad/plaza adjacent to the new Business Center and new Cultural Center.

• The program projects approximately 16 classrooms and nearly 2,900 seats that will accommodate OSU’s expected aggressive growth over the next ten to fifteen years.

• Exploration of demand for active learning settings was a key concern, especially how to foster it in large occupancy spaces, and how to accommodate informal learning spaces with such high volume traffic.

• Space needs included a wide range of room capacities: 600 (or larger) seats; 400 seats; 300 seats; 250 seats; 150 seats; 125 seats; 80 seats; 60 seats; and 35 seats.

• Will also house the Honors College, a Testing Center and cafe. Targeted for completion for Fall term 2014.

This is an example of one of the experimental classrooms at OSU. It is used primarily for teaching physics at round tables, each with access to a large interactive screen. Overhead is a grid that provides power from the ceiling on flexible cables and support for other suspended objects or projectors, allowing flexibility to reposition as needed. The swath down the center is specially treated flooring for physics experiments. Results have been excellent, with data on outcomes showing that all levels of students perform better on nationally standardized tests when they have participated in the active learning courses held in this space, and with higher levels of engagement.
Virginia Tech
Math Emporium

- Virginia Tech took the bold step of converting its large enrollment math classes into an entirely new curriculum based on self-paced hands-on work with math problems. A strip mall building was converted into the Math Emporium, creating a large drop-in computing lab with over 500 stations at round pods for 6.

- Students may come to the center at any time 24/7, but during regular hours teaching assistants and faculty circulate, providing assistance at the time students indicate they need it. On the sides there are areas for large group gatherings, as well as small group meeting areas and lounges with vending machines.

- The Math Emporium received a grant from the first round of funding for course redesign from NCAT, and has gathered data on its outcomes over the ten years it has been in operation. It now serves as a generic model for that type of math curriculum redesign and has been replicated in many institutions that have high enrollment challenges.

(Source: VaTech. Architects: Robert A. M. Stern & Assoc.)
University of Virginia
Claude Moore Medical Education Building

- The Univ. of Virginia School of Medicine needed new facilities and decided to launch a major curriculum reform during the planning. They wanted to reduce time spent in lectures, develop a team based learning approach, and use more of a systems organization for content.
- The new Claude Moore Medical Education Building opened in 2010 and contains a learning studio, lecture hall, student services offices, a Simulation Center and a Clinical Skills Center.
- The large learning studio accommodates a full class of 162 plus observers, with room to circulate between tables. Audiovisual systems are displayed on multiple screens.
- Generous windows were desired for indirect morning light, so the western glass wall is controlled with motorized screens in the afternoon.
- Faculty who have adjusted to teaching in the round prefer it and students are positive. A thorough research program to assess outcomes is in progress.
- Demand has lead to retrofitting of the lecture hall to enable better small group discussion there too.
New Learning Facilities at Other Universities

**Georgia Institute of Technology**

**Clough Undergraduate Learning Commons**

- The G. Wayne Clough Undergraduate Commons opened in August 2011 as part of a new $92.7 million, 220,000 sf building to enhance the undergraduate learning experience, with classrooms, collaborative study areas and support services.
- First year labs for Biology, Physics, Chemistry, and Earth & Atmospheric Sciences
- A Commons that offers 2,100 seats 24/7, managed by the library, and jointly staffed with OIT
- Centralized tutoring, undergraduate advising and academic support
- CommLab for writing and communications support
- Center for Enhancement of Teaching & Learning
- A design that encourages discovery and cross-disciplinary interaction
- Integrated with and connected to the Library
- Café

(Source: GaTech)
North Carolina State University
Hunt Library

- The new Hunt Library now under construction on the Centennial Campus will house the engineering and textile libraries and the Institute for Emerging Issues. Norwegian architects, Snøhetta, have designed a sleek and open building to accommodate NSCU’s innovative library organization.
- A wide range of user spaces will be provided, including a 400p auditorium, 100p lecture hall, commons for ~750p and a Sky Lounge for ~1000p. There will be quiet reading rooms as well as distributed collaborative work areas.
- Teaching spaces will include a learning studio, training room and seminar rooms. A Digital Media Lab, visualization studios and a Technology Sandbox will provide settings for users to work with advanced technologies and resources.
- A high density automated retrieval storage system will house the print collections.
- A key aspect of the planning involved future service point strategy and implications for staffing.

(Source: Snøhetta, Architects)
Glasgow Caledonian University
Saltire Centre

- The Saltire Centre in Glasgow was developed in 2006 as an innovative facility to support learning with the flexibility to change over time. It was envisioned as a mixed use building with a full range of services and settings, from student services and library to collaborative work areas, café and social space all in the same complex.
- The Services Mall has the staff service desks, consultation rooms, workstations and café within a large open area with movable furnishings, that can change with activities.
- It is overlooked by balconies that lead into the upper levels and rest of the quieter library floors above.
- A major hub of the campus, connected to other teaching buildings.
- Award-winning iconic design and documented success as a centre, even while serving a 25% increase in student body.
University of Warwick, UK
Learning Grid

The University of Warwick and their Library decided in 2004 to develop the Learning Grid, which was envisioned as a student-managed learning commons to provide more effective learning support and to encourage social interaction as a stimulus to inquiry-based learning.

- Provides a range of settings for collaboration as well as individual work, multimedia editing and production, plus reference materials.
- Staffed by students trained as learning facilitators, who roam in blue T-shirts to answer resource or technology questions and conduct workshops. They work as a team, give input to budget planning and play a triage function, referring students to librarians and other professional staff dealing with learning success.
- Scheduled consultations and drop-in services are offered by the Library, Graduate School and Centre for Academic & Professional Development.
- Central student support services are located in the adjacent building, for student convenience.

(Source: Univ. of Warwick)
University of British Columbia
Informal Learning Space Planning

- UBC has developed design guidelines for both formal and informal learning space and are in the early stages of testing those out with current building projects.
- A map of the informal learning spaces across campus is available, with information on the type of seating and the hours of operation so users can find the spaces they want to work in.

(Source: UBC)