Flexible Teaching and Learning Spaces—
Trends and Best Practices

In this report, Hanover examines trends among higher education institutions with regard to the development of flexible teaching and learning spaces. Special attention is paid to implementations containing particularly innovative design elements. The report also examines best practices and necessary considerations in developing these spaces.
Introduction

Increasingly, the physical teaching and learning spaces at an institution of higher learning are a consideration for students in deciding on whether or not an institution meets their expectations. Indeed, a 2006 study of US college and university students examined attitudes toward the physical component of colleges and universities found that facilities have a large effect on the recruitment and retention of students to universities. Among the key findings of the study:

- 66.9 percent of students rated overall quality of campus facilities as essential or very important institutional characteristics.
- 58.5 percent of students rated technology capabilities as essential or very important institutional characteristics.
- 50.9 percent of students rated sophisticated technology as extremely or very important in the selection decision process.
- 49.8 percent of students rated classrooms as extremely or very important in the selection decision process.
- 46 percent of students rated classrooms as important to see during a campus visit.
- 40 percent of students rated technology facilities as important to see during a campus visit.
- 23.9 percent of students cited inadequate classrooms as the reason they rejected an institution in the selection decision process.
- 18.8 percent of students said inadequate technology facilities were a reason for rejecting an institution in the selection decision process.

With student attitudes trending toward greater emphasis on facilities that integrate technology—and with new generations of students increasingly interested in collaborative and other learning styles—it is no surprise to see institutional efforts to develop innovative learning space designs that integrate flexible spaces and information technology.

The following report contains a synthesis of trends and best practices with regard to the implementation of flexible teaching and learning spaces. The first portion of the report consists of brief case studies that look at the design principles, funding (when available), technology, and physical attributes of notable flexible spaces. These case studies and corresponding photos were each drawn from a 2006 Educause e-book, entitled Learning Spaces. The section following thereafter will briefly examine best practices and necessary considerations in the development of these flexible spaces.

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Case Studies

LeBaron Hall Auditorium—Iowa State University (ISU)

First used in 2005, LeBaron Hall Auditorium at Iowa State University—a public, four-year, US institution with more than 26,000 students—represents the University’s effort at facilitating “instructor-to-student as well as student-to-student contact.” Few would contend that large lecture rooms serve very well to facilitate instruction that engages students, but ISU’s auditorium renovation shows that these spaces can move toward just that purpose.³

The Auditorium’s reconstruction was one facet of a multi-year project to upgrade ISU’s classroom facilities, the funding for which came from a $14 million bonding resolution spread over the 2003-2005 fiscal period.⁴ In addition to the Auditorium’s renovation, funding went towards reconstructing two physics classrooms and numerous remodeling and upgrading projects in 140 classrooms.

The new 363-seat facility, designed with the aim of encouraging collaboration and active learning, is set out in a 75 degree arc, with six tiers of seating. Each tier contains two rows of seating, “[keeping] the depth of the auditorium to a minimum.” As a result, all students feel relatively close to the instructor. Each tier of seats is comprised of a fixed row of seats and a row of swivel seats capable of 240 degrees of orientation, allowing the students in the front on each level to turn in their seats to collaborate with the students behind them (featured below).⁵

Source: Educause⁶

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⁴ Iowa State University, Accreditation and Planning. http://www.public.iastate.edu/~accreditation/4-learning/331.htm#General
⁶ Ibid.
As one student noted, “[the swivel seating] was so helpful during group discussions and projects. It turned a classroom of 350+ into a small group of four who were able to communicate as though we were the only ones in the room with the instructor.”

Technology is highly integrated into the space’s design. The Auditorium contains dual-projection technology that projects onto a single, continuous, double-wide surface and is compatible with laptops, digital document cameras, and DVD/VCR players. The electronic component is controlled by a simple system—RS-232—and allows for remote controlling by support staff (see below).

Both faculty and students alike have praised the space for its impact on teaching and learning. As Corly Brooke of the Center for Excellence in Teaching and Learning stated at ISU stated, “the best thing it does for my students is create community in the classroom—I can see all the students, and I can get them interacting easily.” Student comments include: “It is my favorite classroom on campus. I felt close to the instructor and ready to learn,” and “No matter where I sat in the room, I felt closely connected with the instructor.”

According to Jim Twetten, Assistant Director of Academic Technologies, Information Technology Services at ISU, the space addresses selected principles for good practice in undergraduate education, as outlined by Chickering and Gamson in 1987:

- Encourages contact between students and faculty
- Develops reciprocity and cooperation among students.
- Encourages active learning.
- Gives prompt feedback.

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7 Ibid.
8 Ibid.
9 Ibid.
Center for Integrated Learning and Information Technology—Michigan Technological University (MTU)

Michigan Technological University – a four-year, public, US institution – has a student body of approximately 6,500 students.

In 2003, construction commenced on The Center for Integrated Learning and Information Technology (CILIT), a 44,000-square-foot addition to MTU’s existing Van Pelt Library and a new 50,000-square-foot science building. The five key design ideals for the facility were: self-directed study, the conversion of the library into an academic learning center, the integration of formal and informal learning functions, increasing the convenience and accessibility of the Center to students, and making the facility a welcoming first image of the University.11 The $35 million project was funded by a $25 million state appropriation and two $5 million gifts from the private donors.12

Designers of the Center tout it as a fully integrated learning environment, offering collaborative study areas and social spaces. The library renovation transformed a 50-year old library into an academic student center, with major collections moved to the lower level of the building on compact shelving. The majority of the upper floors are now reserved for individual and collaborative student work. Major components of the library portion of the Center include a 24-hour 3,400-square-foot reading room (pictured below); an information wall providing up to date digital news on weather, the world, the campus, and the library; 26 small group study rooms suitable for up to ten people; 50 public computers; two general computer classrooms; and a digital studio.13

The new computer science hall includes four undergraduate general-purpose computer labs, two graduate study labs, and special purpose labs—where students can work on cluster computing (i.e. linking multiple computers for increased speed and memory), robotics and artificial intelligence, computational science, distributed computing, graphics, and system administration. A notable feature of MTU’s renovation work is the raised floor system, which allows for the wireless, power, and information technology of the facility to be upgraded and changed if needed in the future with minimal inconvenience.15

At the heart of the computer science hall is a two-story student lounge, offering students a gathering place, featured below:16

16 Ibid.
**ES Corridor Project—Indiana University-Purdue University Indianapolis**

Indiana University-Purdue University Indianapolis is a public, four-year research university in the US with more than 29,000 students.

The ES Corridor Project involved the renovation of one of the University’s main transit arteries – “a main passageway through the Education and Social Work (ES) building, one of four interconnected core academic buildings through which many people routinely pass.”18 Partial funding for the Project came from a community partnership with nearly 30 firms which netted IUPUI $400,000 worth of goods and services, including the furniture used in the renovation.19

The main principle behind the renovation was to design informal study spaces where students could talk; project teams could do their work before, during, and after class; faculty and students could meet before and after class; and commuter students could comfortably study or relax before, between, or after classes.20

Completed in 2004,21 the renovation manifested as a series of learning spaces along the corridor. There are five space types:

- **Space 1**: Study carrels in a traditional layout, but made of modular components, allowing for recombination and rearrangement according to group needs (below);

![Image of study carrels](source: educause)

19 Ibid.
20 Ibid.
Space 2: A “kitchen counter” arrangement, allowing for project work or conversations, along with a sectional sofa;

Space 3: A “walltalker” whiteboard divider with stools, suited to group discussion with a visual component;

Space 4: An arrangement in which cabinetry divides a space into distinct sections for project work, quiet study, and informal conversation (below);

Space 5: And a recycling bar best suited for relaxing and socializing.

IUPUI’s Corridor Project spaces are all wireless-enabled, but upon completing the renovation, designers found that they had neglected to include tools to include enough power outlets for recharging batteries and capabilities that would allow for the projection of images from laptops. The designers noted that similar renovations in the future will likely need to consider integrating technologies in a more systematic way so as to avoid such oversights.

A study on IUPUI’s Corridor Project has highlighted the impact of the space on student and faculty members’ learning and teaching habits, as well as pointed to potential areas for further development. Conducted over a period of four weeks in Fall 2004, the study – led by IUPUI’s Associate Vice Chancellor and Associate Professor of Education, Nancy Chism – found that the most common uses of spaces included: studying, talking, eating, and hanging out. Reflecting on the space, student interviewees noted: “It is easy and comfortable for groups,” and “It helps me get more work done. It’s easier and more convenient.” Faculty noted a variety of resulting advantages from the construction of the new space, stating:

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23 Ibid.
24 Ibid.
25 Ibid.
“My students regularly work in small groups and one or more of the groups will venture to the areas outside during class to discuss and work in small groups.”

“My students use the space…as a classroom extension.”

“Instead of going to my office to discuss a concept after class, I find a comfortable chair to sit and chat with students.”

The study also resulted in a number of important findings and recommendations for future improvement. For one, University administrators learned that the space was particularly valuable for commuter students, as “comfortable spaces promote commuter student engagement with campus.” The study found that commuter students reported “lingering” more and coming inside rather than studying in cars and that “proximity matters” in identifying and constructing informal learning spaces for commuter students with limited time before and after class. In addition, the study suggested that the new space had the potential to promote collaborative learning and foster innovative pedagogy. Indeed, many faculty in adjacent rooms noted they were more likely to send groups outside to work and reported more before and after class interactions with students.

Aside from the need for increased technology capabilities noted earlier in the section, the study also pointed to key areas for development including: attending to comfort (seating, overall design), including good lighting, providing vending machines with healthier snacks, creating more table space for studying, and reducing noise.

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27 Ibid.
28 Ibid.
Perkins Renovation Project and the Link—Duke University

A private research university with more than 12,000 students, Duke University began planning a multi-year renovation project of the Perkins Library – the campus’ largest and most central library – in 2000. According to the designers of the renovation:

The Perkins Renovation Project is far more than an expansion of the library's space—it signals a complete reconsideration of the academic library as a physical place and a qualitative experience. The older Perkins reflected a traditional concept of the library as gatekeeper. Its interior spaces were devoted primarily to the processing, preservation, and security of printed collections, and its layout was confusing for all but the most dedicated of scholars. By contrast, the renovated Perkins embodies a 21st-century vision of the library as gateway and commons, a gathering place for learners rather than a warehouse for books.29

As such, the redesigning of Perkins was undertaken with the idea that repurposing the space previously meant to house books to make it more available to human interactions would lead to a library that would be home to more teaching, learning, and research. Designers noted the concept of “built pedagogy”—the notion that the design of a space will influence the way in which people behave within the space—in their approach to the redesign.30

In 2005, the University revealed two new facilities: the von der Heyden Pavilion café, designed for informal study, collaboration, and special events, and a five-story addition to the Perkins Library named the Bostock Library (below).31 In the new Bostock Libray, students have access group study spaces and frequently consult with staff on content-related questions.

30 Ibid.
31 Ibid.
32 Ibid.
Over the course of the following years, the University opened newly renovated floors, transforming the first floor into a space for student writing and conversation, with comfortable seating placed near to data ports and electrical outlets (below).33

![Image](image1.png)

Source: Educause34

Of particular interest to this report, in 2008, the University opened a “state-of-the-art” learning and teaching center located on the Library’s lower level.35 Named “the Link,” the new learning and teaching center contains six classrooms, four with room for 20 to 30 people, one seating 40 people, and one seating 50 people. Additionally, the facility has four seminar rooms, 11 group study rooms, and a number of informal spaces for individual and collaborative work. Teaching spaces in the Link are configured with projectors and LCD displays, multimedia playback equipment, and other dynamic teaching tools such as: audio/video recording capabilities, multiple flat panel displays, on-site videoconferencing, multimedia production equipment, iPods with microphones, and 160 gigabyte hard disk drives.36

![Image](image2.png)

Source: Duke Magazine37

In each Link space, the furniture is designed to offer maximum flexibility of use. Setup and configuration of room furniture falls to whichever group is using the room

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34 Ibid.
36 Duke University. “Link.” Link.duke.edu
on a particular day. The facility has been appreciated by faculty, one of whom detailed exactly what he loved most about the Link as it related to his teaching:38

- The wall-sized whiteboards, which I fill with conceptual maps and schematics;
- The proximity to librarians, who can help with research projects; and
- The break-out rooms that facilitate small group discussions.

As noted in a promotional video about the Link, faculty members have found ways to integrate new technologies into their teaching as a result of being able to use the Link space. As Deb Reisinger, a Romance Studies faculty member, notes: “We’re going to try a voice thread, which is a new tool at Duke and having students work in break-out groups to be able to videotape themselves and then put that on the screens as well...” Similarly, Brendan Nyhan, a Political Science faculty member, states: “I wanted to teach at the Link this semester because I’m teaching a class on analyzing the 2008 election and I wanted my students to be able to collaborate using the tools available to them in the new classrooms.”39

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Learning Studios—Estrella Mountain Community College (EMCC)

In 2005, EMCC undertook to design novel approaches to the traditional classroom. The result of this collaboration was the transformation of two liberal arts classrooms into “prototype learning studios,” designed to “dynamic, customizable learning spaces that made the most of the face-to-face class experience.”

Prior to the renovation process, the College consulted with key stakeholders – faculty, staff, and students – vis-à-vis focus groups, surveys, and other meetings, in order to learn about their preferences for what constituted a “dynamic learning space.” From this valuable input, the College identified important attributes of “classroom design, media/technology, furniture, lighting, electrical access, wireless access, and… radical flexibility.” In designing the Learning Studios, Estrella administrators focused on empowering students and faculty to take a role in creating their own learning spaces. Central to the design process was a “streamlining” of the classroom, in terms of technology, furniture, lighting, and electrical access. As such, designers focused on customizable spaces with easily accessible technological components. Further, designers sought to leverage the physical space to enhance the experience of learning, engage students, faculty, and staff in discussions about what makes a dynamic learning space; and develop a highly transformable site that could be reformed to fit “changing pedagogical demands.”

The final configuration for the Learning Studios, as pictured below, includes laptops, data projectors, and mobile teaching stations. The furniture in the Studios consists of wheeled tables with leaves that can be removed or reconfigured; ergonomically designed chairs with wheels for easy movement, adjustable lighting, and a combination of whiteboards and projection surfaces throughout.

![Learning Studios Image](image)

Source: Educause

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43 Ibid.

44 Ibid.
It should also be noted that, as a result of stakeholder feedback on the two prototypes, in January 2006, the College opened a new classroom complex that includes twenty two (22) new Learning Studios. Total expenditures for the new Ocotillo Hall totaled approximately $5,373,000 (US), including construction costs, site development costs, and furniture and equipment costs.

Science Center—Hamilton College

Hamilton College in the state of New York – a private, non-profit college with a total enrollment of approximately 1,700 students – renovated and expanded its existing Science Center in 2005. As part of the design process, faculty teams traveled to more than 20 institutions that had recently completed science facilities. Further, campus committees made up of administrators, faculty, staff, and students met with architects and participated in the decision-making process.

The resulting Science Center has classrooms and seminar rooms distributed throughout the building, a move the designers made in order to “keep the building alive.” Designers specifically noted their intention to maximize flexibility within classrooms and allow for different pedagogical approaches. Classrooms, for example, have touch screen controls for computer, DVD, or video image projections. Auditorium spaces are constructed in tiers with two rows of chairs per tier, and are equipped with data projectors with touch screen interfaces. Flat-floored classrooms also have data projectors with touch screen interfaces. The tables in classrooms have wheels at one end so that they can be easily rearranged for seminars, small groups, or lecture.

Laboratories in the new Science Center were designed to facilitate specific pedagogical approaches. There are networked microscopes in the geosciences microscope laboratory, which are connected also to a projector so that the instructor can share the view from one microscope with the entire class (below).
The Science Center also contains multiple kinds of study areas: private rooms, departmental common areas, tutorial areas, etc. Faculty offices are grouped in sets of two to four and have a tutorial area immediately outside. All spaces are designed with the goal of being effective study areas for solo students or groups.\textsuperscript{52}

As one faculty member notes in an online video about the Science Center:

\begin{quote}
This place allows us to do so much more than we ever realized when we first built the building. The facilities are wonderful in that we have every imaginable resource. It’s a place where people feel very comfortable and spend an awful lot amount of time doing their academic endeavors.

The thing that I find most impressive [about] this building are the open spaces, the most magnificent glass walls and open atrium you’ve ever seen. What you find is that students spend a lot more time here. People come across campus to this building.\textsuperscript{53}
\end{quote}

\textsuperscript{52} Ibid.

\textsuperscript{53} Hamilton College. Online Video. “Science Center.” http://www.hamilton.edu/virtualtour/videos/science.html

Key Findings and Additional Considerations

Based on the case studies presented in the previous section, we have noted several key themes:

- **Scale**—Institutions are adopting flexible learning environment standards on a variety of scales according to individual institutional needs and resources. We found that this design ideal is very much at the forefront of institutional considerations when designing new facilities or planning large-scale renovations. It is also a consideration among smaller institutions with less capital to spend. Flexible teaching and learning spaces can be constructed to scale, according to a particular institution’s ability and vision.

- **Stakeholder Input**—Those institutions that did mention input on the design process from students, staff, and faculty also tended to note satisfaction among students following the completion of the space’s construction. While it is possible, and even likely, that an institution can satisfy its stakeholders without their explicit input in the design process, it seems plain that input from students and faculty on the space in which they will be interacting can only serve to improve the outcome of any redesign process.

- **Technology**—Technology played a considerable role in virtually every redesign process. In constructing flexible learning and teaching spaces, it seems it is nearly impossible to succeed without making space within the design for information technology in particular. Wireless Internet connectivity, easily accessed power resources, and other technologies are indispensable to instruction in the 21st century, and thus must be taken into consideration when designing 21st century learning spaces.

- **Standards**—A number of institutions we looked at implemented projection or presentation technology in classrooms and auditoriums. A key process innovation we encountered was the standardization and networking of technology across campuses. A standard control system for instructors ensures that there is no confusion from room to room, and networking of technologies allows for remote tech support in the event of difficulties.

- **Upgrading**—Today’s shiny new technology is tomorrow’s obsolete hindrance. Some institutions are designing their learning spaces and taking obsolescence into account in the process. Along these lines, adopting standardized hardware and software solutions—instead of proprietary or specialized systems—can help make sure any future upgrades progress smoothly.
Mutability—Perhaps the most common facet of the flexible space was movable furniture. It was not uncommon to see institutions mentioning that the tables and chairs were easily moved and reorganized for different study and teaching styles. A classroom that can be changed easily—even, say, in the period between classes—is a classroom that can fit just about any style.

In a flexible learning environment, learners should be able to easily move from listening to a speaker to group work to independent work. Critical for this is the ability to quickly reconfigure a class space in order to accommodate these varied activities. Adding information technology to the mix greatly expands the possibilities of teaching, collaboration, and research within this flexible environment. While these are simple concepts, the actual designing of a flexible learning space has the potential for pitfalls. A poorly designed space—or one that does not adequately take into consideration the needs and preferences of the students and teachers that will be interacting within it—can actually hinder the learning its designers intended to enhance.

According to a recent article in Campus Technology, some key points to keep in mind when designing a flexible space include:

- Bring in the Faculty—Involve faculty in the design process, as they are the ones who are going to be working in these spaces. This sort of engagement also empowers faculty by making them feel a part of the process on the whole. As such, the new space becomes something that they helped build.

- Bring in Student Perspectives—Gauge student input, as students are the other part of the equation for these spaces, and their perception of the new centers will be central to the spaces’ success or failure.

- Flexible Furniture—Invest in tables and desks with wheels or furniture supportive of student team learning. In designing collaborative environments, ask for samples of tables from vendors so that the design committee can test them out. The ideal for a flexible classroom is that an instructor should be able to reconfigure an entire room in the time between classes.

- Technological Redundancy—Technological redundancy means placing no limits on where students gather for projects. With the frequency with which information technology is used in education, institutions must provide students with multiple screens in various places. Computers in pod and clusters and projection screens are necessary to ensure that students are able

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to confer when and where they choose. Also, it is absolutely necessary to ensure easy access to a power supply.

❖ Acoustical Issues—Noise pollution interferes with the learning process; so design spaces with carpeting, sound baffles, removable walls, and other sound dampening methods.

❖ Low-tech components—While faculty and students are increasingly at home working on laptops, tablets, and handhelds, they still will not be working solely on this sort of technology. Invest in low-tech components, such as white boards, projectors, and the like. These low-tech solutions are terrific for brainstorming and other collaborative work, and still much cheaper and more intuitive than their electronic counterparts.

❖ Training—The staff handling the new space should be well-versed in all aspects of its operation. In all likelihood, students will have a good handle on the technology, but faculty and staff will need to be techno-conversant as well. Faculty will need a theoretical underpinning for why the approach that underlies the new learning space will work and how it is supposed to work.
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