Adaptable Spaces and Their Impact on Learning. Research reveals the divide between what is known about the learning experience and the spaces built to support them. This has prompted exploration of new types of spaces. The goal is to understand the role of adaptable spaces in supporting the learning experience. Just as important is an examination of the impact technologies, pedagogies, and, yes, furniture has on these spaces.

Measurement demonstrates the impact space can have on the teaching and learning that occurs on campus. Herman Miller, Inc., has conducted collaborative research on this subject with several institutions across North America.[1] The research involves a new concept for learning spaces known as the Learning Studio.

The Learning Studio evolved from a design pattern for learning spaces first explored and implemented by Eliel Saarinen at the Crow Island School in Winnetka, Illinois, in 1939.[2] This design pattern used an L-shaped model for classrooms. The Herman Miller Learning Studio design was inspired by an artisan's studio. The result is an adaptable space designed to meet the needs of students and faculty who learn and teach in the space. The Learning Studio is also able to actively take into consideration the evolving learning styles and preferences among students, emerging pedagogies, and physical characteristics driving the design of effective learning spaces.

Research Methodology

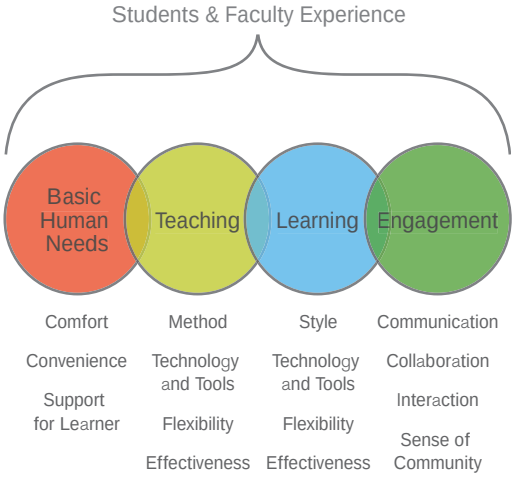
To better understand the experiences in the Learning Studio, Herman Miller developed the Learning Studio Research Program. The collaborative research effort consists of an evaluation, a structured process, and flexible approaches to the learning space. It encompasses data collection, the sharing of insights about learning and teaching preferences, and overall experiential perceptions of both students and faculty about the learning environment.

The goal of the research is to provide participating institutions with the opportunity to test new approaches to learning spaces on a smaller scale prior to moving forward with larger scale plans.

Colleges and universities that participate in the Learning Studio Research Program commit to a two-term engagement in the program. The research methodology for the program includes a survey completed at the beginning of each term that measures student and faculty perceptions about the traditional learning space, with a focus group session administered three-quarters of the way into the term, and an additional survey at the end of the term used to gauge the perceptions of the students and faculty experiences in the implemented Learning Studio.

The goal of the research is to provide participating institutions with the opportunity to test new approaches to learning spaces on a smaller scale prior to moving forward with larger scale plans. The data and insights collected can guide an institution toward more effective learning spaces in the future. As Dr. Gene George, executive director of research and effectiveness for Butler Community College, noted, the research reinforces the value of engaging faculty in the R&D process. "This project has given us the opportunity to combine research and practice, shaping what we ask next," he said. "In this way, R&D has become more than research and development. It has been for us research and discovery—discovery of what we don't know about ourselves and the creation of new abilities to apply knowledge to improving student success."[3]

The process of collecting, mining, and aggregating the data from research at a number of institutions has yielded another result: common themes related to the design of spaces that support, enhance, and contribute to the teaching and learning experience.



From this work, four key constructs have emerged: Basic Human Needs, Teaching, Learning, and Engagement. These constructs guide the research methodologies used in the program, shaping questions asked in surveys and providing a framework for identifying actionable results.

This paper presents cumulative research results from participating institutions. These results indicate the relationship of the Learning Studio to the four constructs. The discussion that follows shows clearly identifiable ways the Learning Studio addresses design attributes that support the learning constructs.

Basic Human Needs

What may seem obvious to many, it all starts with the users – students and faculty. At a town hall meeting on the campus of Indiana University–Purdue University Indianapolis (IUPUI), faculty were startled to hear two of four student panelists confess that they had dropped classes because of uncomfortable chairs in the classrooms. Such testimony takes the subject of comfort into the realm of attrition.[4]

Learning spaces that are physically and psychologically comfortable promote a sense of well-being, keep minds focused, and limit distractions. Comfort is not always a quantifiable phenomenon, but we know that when people are uncomfortable, they are distracted. Temperature, lighting, and furnishings all play a role in a person being comfortable.[5] The traditional tablet armchair with its limited work surface is simply too small and uncomfortable for many of today's students.[6] [7]

Furniture criteria should consider the "pedagogical value of a comfortable chair,"[8] together with surfaces for writing and supporting computers, books, and instructional tools (smart boards, video screens, mobile whiteboards). Aggregate results from the Learning Studio Research Program research reveal that for students, comfort and flexibility positively contribute to their learning experience.

When provided with design elements in the Learning Studio that could be easily moved or adjusted, students did so more frequently than in traditional classrooms. The ability to move and adjust furniture, seating, whiteboards, and tables supported the students' heightened learning experience with increased seating comfort (32%), being able to clearly understand the professor (14%) and view materials (17%).

Learning environment flexibility and comfort is also a shared basic need of faculty. Research revealed that five features within the Learning Studio are moved or adjusted more frequently by faculty as compared to the traditional classroom: seating, tables, whiteboards, lighting, and the location of technology.

The ability to move and adjust Learning Studio design elements contributed to increased satisfaction by faculty in the following areas:

- Quality of lighting (26%)
- Access to an Internet connection (25%)

- Ability to hear students (17%)
- Having sufficient whiteboard space (9%) and work surface space (13%)
- Ability to organize materials (5%)

Recognizing the impact that physical comfort has in support of pedagogy, and designing flexible, comfortable learning spaces enhances the experiences of both faculty and students. However, the affects of psychological comfort in the learning environment are just as important.

Recognizing the impact that physical comfort has in support of pedagogy, and designing flexible, comfortable learning spaces enhances the experiences of both faculty and students. However, the affects of psychological comfort in the learning environment are just as important.

Psychological comfort relates to uniquely human needs, such as the ability to control elements of one's job, to personalize one's space, to set boundaries, and to connect with nature or beauty.[9] Environmental and evolutionary psychologist Judith Heerwagen writes, "A growing body of research shows that building environments that connect people to nature are more supportive of human emotional well-being and cognitive performance than environments lacking these features."[10]

To address and support faculty and student well-being, the Learning Studio experience suggests that the learning environment include outward-facing windows with views to the landscape or nature. This is one way the Learning Studio Research Program seeks to discover and meet the physical and psychological basic needs of students and faculty.

Learning Studio Design Elements & Considerations

Architectural	Attributes
Floor plan, layout	Flexible to support teaching and learning, good flow and easy movement; no obstructed views or acoustic limitations
Paint	Enhance and inspire with wall color; brighten but not illuminate
Flooring	Durable, color enhancing, easy way-finding and a source of sound proofing
Acoustics	Sound enhancing and sound proofing
Lighting	Appropriate for group and individual activities with the ability to change to support multimedia use
Furniture	**Attributes**
Tables (student & faculty)	Ergonomic with sufficient work surface space to support multiple uses by faculty and students, easy to move and adjust
Chair, side chair	Ergonomic, flexible, comfortable and easy to move and adjust
Bench seating	Ergonomic, flexible, comfortable and easy to move and adjust
Café tables & stools	Supports eating, socializing, reading, completing class work and connectivity
Instructor's lectern	Ergonomic, adjustable, sufficient work surface space, easy to move and adjust
Filing & storage unit	Sufficient space to hold paper files, books, binders, personal belongings, easy to move

Accessories	Attributes
Mobile marker board	Easy to write on, view, move and store
Whiteboard	Easy to write on and view
Technology	**Attributes**
Cables, wiring & technology placement	Designed to support multiple teaching mediums; hidden cables and wiring for appearance and safety; placed for easy viewing throughout the space
Training	**Attributes**
JIT application	Develop and deploy just-in-time training program to inform and educate faculty and students about ergonomic and flexible features and how to tailor the learning space to meet varying needs

To support effective teaching, a classroom design should make it easy for an instructor to synchronize those elements and be flexible enough to accommodate different teaching styles.

Teaching

Emerging discoveries about how people learn, rapid advancements in technology, and heightened awareness of student expectations serve as drivers for the development of new pedagogical models. These discoveries are guiding educators toward learner-centered approaches that elevate learning to new levels where attention is paid to the knowledge, skills, attitudes, and beliefs that learners bring to the educational experience.[11]

So, what are the characteristics of good teaching? The Learning Spaces team at Butler Community College in El Dorado, Kansas, answers that question in this way. Butler's team defines an effective teacher as someone who orchestrates pedagogy, tools, and environment in a way that creates opportunities for students to learn. To support effective teaching, a classroom design should make it easy for an instructor to synchronize those elements and be flexible enough to accommodate different teaching styles.[12]

In support of teaching, research results found that 24% of faculty feels it is easy to reconfigure the Learning Studio furniture to support teaching methods, and 43% feel the overall learning environment layout supports different teaching styles. With respect to Learning Studio layout, results indicate a 27% increase in faculty member's ability to hand out materials to students and a 26% increase in their ability to interact with students.

Faculty from the University of Utah Studio Pilot pointed to the value for faculty participating in the Learning Studio Research program to explore new pedagogies, build expertise in new technologies, and build a sense of community by engaging students. These actions will help guide students to develop what author Daniel Pink describes as inventive, empathetic, big-picture capabilities.[13]

Learning

Whether or not one subscribes to Daniel Pink's position that critical thinking skills and aptitudes are necessary in the future workplace, his ideology is closely aligned to what is known about how people learn. Our understanding of knowledge is evolving as new sciences offer insights as to how a person constructs knowledge about and makes

sense of the world. This meaning of "knowing" has shifted from being able to remember and repeat information to being able to find it, use it, and contextualize it.[14]

Facts are important, but the new science of learning shows that "usable knowledge" is not the same as a mere list of disconnected facts. It requires a more active approach to learning.[15] Active learning emphasizes the importance of helping people take control of their own learning. Students who become active learners seek to understand complex subject matter, are better prepared to transfer what they have learned to new problems and settings, and develop a competence in the area of inquiry.

What types of learning spaces will meet the learning expectations of these students? Author and consultant Marc Prensky writes that students are not interested in large lecture halls. They prefer informal, small-group discussion—often through text messaging or e-mail—as a means of gaining understanding of the curriculum. They want a learning space that allows them to get to know one another, engage in dialogue, work independently or in groups on projects, and get or provide feedback. In general, they seek a collaborative environment that fosters understanding and learning.[16]

Regarding communication and collaboration, students in the Learning Studio reported they were 16% more likely to feel comfortable asking questions and 28% more likely to be able to conduct group work.

The aggregate results from the Learning Studio Research Program validate Prensky's position. The data shows that for students participating in the Learning Studio spaces:

- Lecturing is 21% less likely to be used as a learning activity
- Classroom demonstration is 6% more likely to take place
- Class discussion is 17% more likely to take place
- Small group work is 9% more likely to take place

Regarding communication and collaboration, students in the Learning Studio reported they were 16% more likely to feel comfortable asking questions and 28% more likely to be able to conduct group work.

Communication and collaboration play pivotal roles in the learning experience, particularly in the process of the transfer of knowledge. Some types of learning experiences result in effective memory but poor transfer, while others may provide effective memory and positive transfer. Additionally, time to learn is important. There has to be a realistic approach to the amount of time it takes to learn complex subject matter. The development of expertise occurs only with major investments of time. The amount of time it takes to learn material is proportional to the amount of material being learned.[17]

Being able to support the transition from traditional teaching and learning to these new approaches requires the overall learning space to respond in new ways. Learning Studio design elements, such as mobile furniture and whiteboards, provide students and faculty with the ability to change the environment to meet their pedagogical and collaboration needs. It also provides an informal learning space that can be accessed by students between scheduled classes, providing additional opportunities for students to continue collaborations that begin with the class assignment. While there is no "one-size-fits-all" approach to learning spaces that support the learner, our research indicates that these learning space attributes do in fact enable the learning process.

Learning Studio Results Matrix

Design Elements	Basic Human Needs	Teaching	Learning	Engagement
Architectural				
Floor plan, layout	●	●	●	●
Paint	●			
Flooring, acoustics, & lighting	●	●	●	●
Furniture				
Tables (student & faculty)	●	●	●	●
Chair, side chair	●	●	●	●
Bench seating	●	●	●	●
Café tables & stools				●
Instructor's table/lectern		●		
Filing & storage unit		●		
Accessories				
Mobile marker board/Whiteboard	●	●	●	●
Technology				
Cables, wiring & technology placement	●	●		
Training				
JIT application		●		

Engagement

For most, if not all, colleges and universities, the focus of their mission statement revolves around enabling student success. Traditional predictors of student success that have generated the most interest by educators are graduation rates, student retention, and student engagement.[18] According to ACT, Inc., the nonprofit testing group, in the academic year 2007-2008, 66% of first-year college students returned to the same institution for their second year of college, 30% of students dropped out completely after their first year.[19]

Educational practices that contribute to student success have been a topic for discussion since Arthur Chickering and Zelda Gamson authored "Seven Principles for Good Practice in Undergraduate Education" in 1987.[20] Their seven practices include:

1. Interaction between faculty and student
2. Student-to-student collaboration and cooperation
3. Active learning
4. Prompt feedback from faculty
5. The amount of time students spend on their studies
6. High expectations from faculty and staff
7. Respect for diversity of talents and learning styles

Results from evaluations show that in the Learning Studio students are 24% more likely to feel engaged in class and 23% more likely to feel that communication between students has been enhanced.

In addition, the writings of George Kuh, Robert Barr, and John Tagg have provided further research support for the development of the Engagement construct. And their thinking has influenced key design features of the Learning Studio that support communication and interaction between the participants in the learning experience.

The flexible layout of furniture in the Learning Studio allows faculty and students to see each other with ease, to hear the information provided to them, and to feel the enthusiasm and excitement than can be part of the learning experience. Results from evaluations show that in the Learning Studio, students are 24% more likely to feel engaged in class and 23% more likely to feel that communication between students has been enhanced.

The layout of the Learning Studio lets faculty members arrange the room in ways that help build community, to keep the "buzz" going, and to facilitate different types of activities. Faculty can move about the space and access whiteboards that cover the walls. As a result, faculty report increases in teaching capability: 15% feel they can teach more effectively, 22% can easily integrate teaching methods, and 21% can easily use technology as part of teaching methods.

Not surprisingly, faculty members are 24% more likely to feel that collaboration with students has increased. When asked whether the Learning Studio supports student learning, 30% of faculty strongly believe the design is supportive and 24% feel the space supports teaching capability success.

Additional insights came from evaluating faculty and student perceptions about collaboration and fostering a sense of community or belonging within the Learning Studio. Students reported they are:

- 16% more likely to feel comfortable asking questions
- 28% more likely to be able to conduct group work
- 20% more likely to feel the classroom presents the appropriate image for the college
- 22% more likely to feel valued

The results from faculty were even more supportive. Faculty members are:

- 32% more likely to agree that collaboration between students is better
- 24% more likely to agree that collaboration between faculty and student is better
- 44% more likely to believe the Learning Studio conveys the appropriate image
- 47% more likely to feel valued

That learning spaces, such as the Learning Studio, must meet pedagogic needs and support varying teaching and learning styles is without question. That these same spaces can elicit such positive responses in terms of conveying an appropriate image and making students and faculty feel valued is quite remarkable. What we know from the research is that there is a close connection between these positive feelings and perceptions and stronger engagement and improved retention.

Responses both from faculty and students indicate that the atmosphere of the Learning Studios meshes with their expectations for higher education.

Conclusion

As shown in a recent survey, co-sponsored by Herman Miller and SCUP (Society of College and University Planning), while 84% of respondents stated they would be doing something significant on campus in terms of construction or renovation, only 21% had any formalized process designed to measure the effectiveness (impact on teaching and learning) of the spaces they are creating.[21]

Findings accumulated as part of the Learning Studio Research Program provide evidence that flexible and adaptive design supports the core pedagogic constructs of basic human needs, teaching, learning, and engagement. Doing so addresses a simple yet vital equation: the sum of people, pedagogy, and place equals possibilities that can enrich teaching and learning for students, faculty, administrators, and the community.

The insights provided through the Learning Studio Research Program set the framework for how future learning spaces might be created. Responses both from faculty and students indicate that the atmosphere of the Learning Studios meshes with their expectations for higher education. The furnishings and the environment communicated to them a level of professionalism, trust, and value that traditional classrooms did not.

Students described the Learning Studios as "welcoming" and "relaxing." Because of the flexibility of the Learning Studio, both faculty and students alike felt that they had more control over the learning space and possibly their own learning. This is important because research has found that "high levels" of perceived control over one's work increases job satisfaction, commitment, involvement, performance, and motivation.[22]

Beyond understanding how the Learning Studio fosters student engagement, this work also provides a college or university with the opportunity to experiment with learning spaces to determine what works and what doesn't work with its specific campus culture, pedagogies, and space management processes. This type of experimentation sets the foundation for evidenced-based design that can potentially save millions of dollars in building costs over a period of time by first understanding what works so that learning spaces can be built to meet both current and future needs.

Notes

1 Research participants include Estrella Mountain Community College (Arizona), Eastfield Community College (Texas), Central Michigan University (Michigan), Butler Community College (Kansas), University of Michigan (Michigan), University of Utah (Utah), and Portland Community College (Oregon).

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[22] Herman Miller Inc., "Home Sweet Office," Herman Miller Research Summary, 2008.