

By Chris Johnson and Cyprien Lomas

DESIGN

OF THE LEARNING SPACE

Learning &
Design
Principles

*The only true voyage ...
would be not to visit
strange lands but to
possess other eyes, to
see the universe through
the eyes of another, of
a hundred others, to see
the hundred universes
that each of them sees.*

—Marcel Proust,
In Search of Lost Time

When asked to define the “spaces for learning” on campus, most in higher education identify the classrooms or laboratories. These “formal” spaces are usually controlled via parameters such as scheduling requirements, set hours of use, set number of seats, and predetermined learning activity patterns such as lectures or discussions. Though classrooms and laboratories come first to mind, auditoriums, performance rooms, computer labs, and studios are other examples of campus spaces that, under these parameters, can be defined as formal learning spaces.

But what about all the other spaces on campus? As Malcolm Brown, of Dartmouth, states in *Educating the Net Gen*, “Net Gen students, using a variety of digital devices, can

turn almost any space outside the classroom into an *informal* learning space.”¹ What, then, becomes the role of spaces such as faculty offices, hallways, plazas, courtyards, dormitories, and food service areas? Designers have traditionally studied courtyards, plazas, and hallways for usage and flow patterns. Learning space designers must now consider the instructional implications of these spaces. Although discussions about these spaces still need to be concerned with usage patterns, a more important issue is: What types of learning activities should be facilitated in these spaces, and what type of infrastructure is needed to support these activities?

As students become increasingly digitally literate, higher education also needs to be concerned about the creation and support of virtual learning spaces. Anyone who has stood outside of a class as it is dismissed has witnessed the number of students using

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cellphones to call a friend or check for text messages. These “digital natives”² are literate with the tools of the twenty-first century and remain connected through multifaceted, complex social interactions, both physical and virtual. As we design meaningful learning experiences, we need to be aware of how the potential of virtual learning space influences what happens in the formal and informal physical learning spaces. Therefore, a definition of *learning space* might be the following, as stated by Brown: “Learning spaces encompass the full range of places in which learning occurs, from real to virtual, from classroom to chat room.”³

The Traditional Approach to Space Design

Each institution has processes and procedures for remodeling or creating a space. In a traditional design process, the department sends a request for space remodeling to the college or university. Some sort of formal approval process is begun, often involving a number of committees, organizational units, and people. Once the request is formally approved, a project manager decides if the work can be done in-house or must be contracted out. If the project cannot be done within the institution, the project manager hires a designer or architect, depending on the scope of the project. If the project is large, an architect determines the needs of the department in the programming phase and then creates the design. Usually, this process focuses on the design of classrooms and labs driven solely by space needs, that is, one classroom for 300 students, three for 150, etc.

To make sure that the project is on track, the architect holds periodic reviews with representatives of the department and/or the institution until a design is complete. Contractors are hired, and based on the design developed by the architect, construction or remodeling of the space begins. Often at this point, the only people who are concerned with the process are the institution’s project manager, the architect, and the contractor. Construction then continues until the remodeling or construction is complete. During this time, numerous decisions are made regarding the actual construction as budgets are cut and priorities are

shifted. All these things can cause a construction project to stray from the original instructional intent and can lead to a mismatch between design and reality. This, then, is the context within which design decisions are typically made.

This process is changing as architects and designers are becoming more familiar with instructional and student needs. However, the task of clearly communicating the desired outcomes can still be fraught with miscommunications. The process of learning space design offers strategies and language to facilitate discussion among campus planners, architects, and other stakeholders to ensure that the new space is designed around learning needs instead of space requirements. Underlying this process are the institution’s values about what makes successful teaching and learning. These values define how people see, talk about, and feel about what should happen in a learning space. By focusing on these values, instead of simply meeting space requirements, an institution can revolutionize the design process to create learning spaces that meet the needs of both faculty and students.

A New Way to View Design

Phillip Long and Ed Crawley have proposed a different view of the design process. This new view, based on the Conceive, Design, Implement, Operate (CDIO) process of engineering, begins with seeing the learning environment as a “product” to be developed rather than simply as a space to be redesigned.⁴ The product has certain characteristics that are based on the institution’s values about learning, or “learning principles.” These learning principles become the driving force within the design process and are the benchmarks through which progress is measured and decisions are made. Throughout the entire process, the client (the department, college, or university) remains the expert in the product—learning—while the architect remains the expert in space development. To guide this process, the client should appoint a full-time champion who has the domain and departmental expertise necessary to see the project through. Thus, the learning needs of the discipline drive the planning process.

The champion works with various members of the department, college, and university to identify the vision, needs, goals, concepts, principles, requirements, and methods of evaluation to complete the project. During this phase, the champion creates a team of people to help guide the process. This team includes

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faculty members and students who use the space, campus representatives, architects, and other interested stakeholders.

Working under the direction of the champion, the team plans the design of the learning space. First, the team begins by identifying the institutional context within which the space will be constructed. The next, and most important, step is to specify the learning principles that are meaningful to the institutional context. Third, the team defines the learning activities that will occur within the space to support these learning principles. In the fourth step, the team develops clearly articulated design principles that support the learning principles and learning activities. Next, the team creates a set of requirements

that can be communicated to those who will carry out the renovation or construction. The sixth and last step is to determine a methodology for ongoing experimentation, evaluation, and improvement to assess whether the new space is a success. These steps combine to create an iterative dialogue among the design team and other stakeholders in the design process.

At this point, after everyone has a clear idea of the learning and design principles that will guide the construction, the architect is hired. The champion, collaborating with the architect, then works to

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gain formal approval for the project from the institution. The team is responsible for monitoring the project from start to finish, based on the learning and design principles developed in the previous phase. If something in the project must be cut or modified, the decision is made by the team after asking the question, “How will this affect the implementation of the learning and design principles?” This process gives the institution the benchmarks it needs to ensure that the

“product”—that is, the renovation or new construction—meets the needs and goals of the institution.

Changes

Before taking these steps to determine the principles that will guide the process of designing the learning space, the planning team should consider changes in life-cycles, in how people learn, in the technologies used for teaching, and in the students themselves.

Life-Cycles

The life-cycles of buildings are much longer than the life-cycles of technologies or even of learning theories. Plans usually allow for buildings that will last fifty to eighty years. In contrast, a technology refresh cycle suggests that computer hardware should be replaced every two to four years and that nondigital assets such as blackboards, desks, and tables should be refreshed with an eight- to ten-year cycle. These rapid changes are requiring us to rethink how we teach and learn. Effective practices are emerging around these very new technologies as users collectively figure out what can be done with them. Discussions of space must thus include how to meet this rapid change. The planning team should ask: “Can we be sure that the spaces built today will still be useful later in their life-cycle?” “How do we support, update, and modify these spaces in a rapidly changing environment?”

How People Learn

Numerous changes are occurring in the teaching and learning process. This material has been summarized in the National Research Council book *How People Learn*, which provides a comprehensive starting point to understanding how individuals learn and what types of environments are best to support learning.⁵ For example, one key finding outlines the difference between expert and novice learners. Expert learners have a more developed scaffold of experiences and knowledge that allows them to assimilate and process new information quickly. Novice learners will fare better if they can reconcile new information with prior knowledge. Expert learners are able to transfer problems and data from one context to an-

other with greater ease than novices. Self-conscious reflecting on learning, or metacognition, is a particularly effective tool to promote deeper learning.

Deeper learning goes beyond the memorization of facts for later recall; it implies a disciplined perspective similar to that of a practitioner, professional, or scholar. In contrast, shallow or surface learning may permit short-term mastery of facts with reduced long-term retention. Colleen Carmean and Jeremy Haefner offer a view of the deeper learning that occurs when learning is social, is active, promotes student ownership, is collaborative, includes prompt and ongoing feedback, and is reflective.⁶ Other works, such as “The Seven Principles of Good Practices in Undergraduate Education,” *How Students Learn, Knowing What Students Know*, and *Educating the Net Gen*, provide additional insight into the nature of learning and learners and the environments that enhance learning.⁷ These findings reveal the importance of being aware of how people learn and the implications for how to set up environments to promote learning. Identifying these meaningful learning principles helps to determine the key methods needed to achieve that deeper learning. The planning team should ask: “What learning theories and practices meet our instructional needs, as well as the learning needs of our students?”

Technologies Used for Teaching

New technologies and their adoption have always had an influence on what happens in the classroom. The recent widespread adoption of tools such as course management systems and the availability of wireless access in classrooms are promising to change practices once again. These tools are allowing students and teachers to find new ways to communicate, collaborate, and interact. Ubiquitous access to information has helped to shift the emphasis of education away from the simple transmission of information to an active acquisition of skills and knowledge. Other uses for technologies have given rise to applications that facilitate team-based, collaborative, and inquiry-based approaches to constructing knowledge. The planning team should ask: “How will the technologies help facilitate the learning principles?”

The Net Generation

Many students are much more comfortable with technology than are their teachers. Students who prefer instant messaging to face-to-face meetings are said to be part of the Net Generation.⁸ “Net Gen” students have preferred modes of interaction, communication, and socialization, and these differences are putting pressure on higher education to change. Current and new students may be less willing to spend a large part of their education in large lecture halls. Instead, they may prefer to augment, or even replace, their lectures with formal and informal small-group discussions with peers. Rather than write a term paper, some may want to create a short digital story to demonstrate mastery and competence. This new generation of digital natives will change the nature of higher education. As Marc Prensky has stated: “Our students have changed radically. Today’s students are no longer the people our educational system was designed to teach.”⁹ The planning team needs to ask: “What technology skills and preferences do students currently have?” “What skills will they have in the future?” “What skills will they need?” “How will we meet these needs?”

Identifying the Institutional Context

As the planning team begins the design process, it needs to discuss the context of the institution. Exploring the institutional context—values, culture, strengths, and limitations—will allow the team to set boundaries that everyone can agree with. This should be a continuing conversation, started at the very beginning of the process and extending long after the learning space has been created. Through these ongoing conversations, definitions and boundaries can be constantly tested, and pushed, to ensure that the learning space is what is needed to achieve the learning goals. Setting the boundaries allows the team to focus the discussion, define common terms, and set the parameters within which it will work. Doing so also provides a common language for explaining the space to those outside the project.

For example, suppose the planning team has been tasked with renovating an existing classroom—a moderate classroom space that accommodates sixty stu-

dents and that is used by a variety of general education courses. By coming to a consensus on how the institution defines this formal space, the team can identify which interested parties need to be brought into the conversation. Within the context of the campus, this may mean that faculty from math and English, two primary users, should be consulted on the learning activities to be supported; personnel in room scheduling should be asked about future use patterns; those in charge of central support of audio-video equipment should be consulted about who is responsible for maintaining and refreshing the equipment; and both local and central networking staff should be asked about the placement of wireless access points so as not to interfere with the existing infrastructure. The team may even decide that someone from custodial services should be consulted because proposed changes may make it difficult or impossible to keep the room clean.

Discussing, defining, and refining the institution’s understanding of the learning space also allows the planning team to explore the institutional parameters within which it will work. Again, within the context of the institution, the team may need to discuss issues such as ownership of the space: Does the new space fit into the overall campus plan? Will increasing or decreasing the available number of seats affect established enrollment quotas? Is there sufficient budget to build, support, and modify the space?

This conversation becomes even more complex when informal spaces are considered. Therefore, it is important that discussions about the learning principles and activities be kept in the forefront of the conversation and that they be carried out within the context of the institution. In doing so, everyone on the team has a clear idea of the space being developed and of the activities that the space will, and will not, support.

Specifying Learning Principles

As the planning team progresses in the design process, it must now take what has been discovered about learning theories, processes, new technologies, and new learners and identify the deeper learning principles that are meaningful to the institution. Continuing with the previous

example, assume the team has decided to focus on “The Seven Principles of Good Practice in Undergraduate Education.”¹⁰ Since one goal of the institution’s mission is “to promote collaborative inquiry across the disciplines,” the second principle—“develops reciprocity and cooperation among students”—is of particular interest to the math and English departments. The team has also identified several of the “Learner-Centered Psychological Principles” as being important to the institution.¹¹

What is important is that the team identifies a set of principles that promote learning and are meaningful to the institution.



The math and English departments have discussed these various theories and philosophies, and from their explorations, they now begin to develop a set of learning principles. The principles may simply quote work from another source—for example, “We believe that ‘the learning of complex subject matter is most effective when it is an intentional process of constructing meaning from information and experience’”¹²—or they may be a combination of principles expressed in a way that is meaningful to the institution—for example, “We believe that all students

learn through collaborative work and should have access to the tools and resources to facilitate this work at any time of the day or night and in all spaces of the institution.” In a sense, it does not matter what learning principles the team identifies; what is important is that the team identifies a set of principles that promote learning and are meaningful to the institution.

Defining Learning Activities

Once the learning principles have been identified, the planning team must then determine the specific learning activities that facilitate these principles. For example, problem-based learning, small-group work, study teams, and synchronous and asynchronous online communities of practice are just some of the activities that promote collaborative learning. At this stage of the design process, the team must decide which of these activities the learning space should support in order to facilitate the previously defined learning principles.

Again, the team should work to identify these activities within the context of the institution. For example, even though the faculty may be ready to support problem-based learning and study teams, the infrastructure may not yet exist to support online communities of practice. Or, the faculty may be supportive of small-group work but may be unsure how to implement such work in a large-classroom environment. Therefore, the planning team needs to explore and experiment with a variety of learning activities before proceeding to the next step.

Developing Clearly Articulated Design Principles

Once the team has identified the relevant learning principles and the supporting learning activities, it is ready to develop a set of design principles. Design principles will allow the team to facilitate its desired learning principles by describing what most students and teachers should be able to do in the space.¹³ We say *most students and teachers* because the team needs to recognize that it may not be able to accomplish all that it desires, based on a number of constraints on the space. The budget may be insufficient, the infrastructure may be

lacking, or the institution may just not be ready for a particular innovation. At this point, the team must weigh what is possible today and what may be possible in the future and decide what it wants to support, based on the learning principles it has developed.

Ideally, design principles should include a description of the learning activities in which students and teachers will participate. For example, the team may identify the following learning principle as being important: *Learning that is social re-*

quires feedback and interaction among participants. A learning space should enable learners to get to know each other and engage in dialogue, work on group projects, interact in a variety of ways such as collaborative or cooperative learning, and present their work publicly, teach others, or give feedback.

For each aspect of this learning principle, the team members should ask: “What does the space need to do in order to support this principle?” From their discussions, they develop the following design principle: *The space will allow the teacher and*

students to (1) display multiple types of resources simultaneously, (2) do so easily, simply, and (3) with continuity across spaces without being tied to a physical location, and (4) provide distributed control of presentations.

As the team develops its design principles, members need to remember that these principles may conflict with one another. The principles may also conflict with, or be complemented by, other types of design inputs such as budget constraints,

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physical limitations, or the need for flexibility. The important task is to develop all of the design principles and then come to consensus about what will be gained, and what will be lost, when two principles are in conflict.

During this stage, the team also needs to guard against becoming bogged down in trying to describe specific spaces or tools. The conversation often quickly turns to questions such as: “Do we want U-shaped seating, separate tables, or conference-type seating?” “How many ceiling-mounted projectors do we need?” Although these are important questions, they must be tabled until after the learn-

ing principles, learning activities, and design principles have been discussed and decided on.

Creating a Set of Requirements

After developing the design principles, the team needs to determine the physical requirements that will bring about the desired learning outcomes. To continue the previous example, the team has decided to implement a learning principle that allows students and teachers to *present their work publicly, teach others, or give feedback* with a corresponding design principle that *will allow the teacher and students to (1) display multiple types of resources simultaneously, (2) do so easily, simply, and (3) with continuity across spaces without being tied to a physical location, and (4) provide distributed control of presentations.* A requirement for such a space might be: *The space, at a minimum, will provide the following: four display screens with video projectors, visual presenter; VCR, DVD, wireless overlay, twenty tablet PCs, wireless connectivity to the Internet, wireless connectivity to the presentation system, power outlets in the walls and floors, productivity software, and shared presentation software.*

After everything has been discussed and clearly defined, the team is ready to work with campus planners, architects, and other experts to refine and move forward on the construction of the new learning space. As the team proceeds to market the space to campus planners, students, alumni, the architect, and other interested stakeholders, it will be able to refer to the principles to guide the development of architectural and construction plans. More important, this work provides a roadmap to make decisions as the renovation or construction process moves forward.

Determining a Methodology for Assessing Success

As plans unfold, the team needs to take all that has been learned and develop methodologies to assess the success of the new space. One of the most valuable processes of exploring learning spaces is the ability to discover uses and practices that were previously unknown. Creating a flexible learning space and providing the users of this space with an adequate level of technical support is a particularly useful way to uncover new uses. Experi-

mentation also helps to uncover shortcomings in the usage of a designed space. Often, the simplest things contribute to a space not working as well as it should. By including experimentation and an appropriate means for measuring success into the design process of a learning space, the planning team can create an opportunity for greater longevity and flexibility in the learning places. In the best cases, it may also observe an evolution of practices that are associated with a new learning space.


What is the best way to experiment with a learning space? Providing ample technical support for the users of a space is one way to ensure that it is being used to the full potential of the space and its operators. This should also help to implement the vision of the creators. Supporting the creativity, experimentation, and playfulness of the users can uncover potential new uses. Often, faculty members have their hands full struggling to provide a good environment for their students and are unable to reflect on how to make a space work better. If instructors receive support, they may be freed to explore more creative uses of a particular space. Encouraging students to explore new uses for a space is also effective. Often, it is not until a space is pushed to its limits that the desirable (or lacking) features can be identified.

A space may be deemed successful if it is used in the manner that the creators envisioned. Even better, the space may be used, productively, in ways that were not originally envisioned. In other cases, a space may be successful because it is always busy. Still other spaces may be successful because they are cost-effective to provide. Identifying the guiding learning principles and the corresponding design principles provides a good set of guidelines to determine the success of a space. Does a space promote deeper learning? Is a space conducive to the type of arrangement/amenities needed to support a learning activity? In the previous example, processes might be developed to track the evolution of writing through the use of electronic portfolios or to assess the effectiveness of providing access to spreadsheet or simulation software in the math curricula. Determining the success of the space to support deeper learning is

a good way to determine the success of the space itself.

Finally, in determining the success of a space, the team should ask: How can we make this space work better? How do we determine the best usage of this space? Are there best times to use this space? Are new practices emerging within these

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spaces? Can we capture these practices to share with other users? Who will maintain the space? How do we ensure that the technology within the space continues to evolve?

Conclusion

Designing a vibrant learning space can be a daunting proposition. There are many places along the path where the planning team can lose its way and end up with “just another classroom” or “just another building.” However, institutions can create learning spaces that will transform their ability to teach current and future students by taking the following steps: (1) identify the institutional context; (2) specify learning principles meaningful to that context; (3) define the learning activi-

ties that support these principles; (4) develop clearly articulated design principles; (5) create a set of requirements; and (6) determine a methodology for assessing success.

Although we have detailed specific steps, the planning team should remember that designing a learning space is an organic and iterative process that continues long after the space is complete. For example, Dan Gilbert, computing information analyst for the Stanford Center for Innovations in Learning at Wallenberg Hall, stresses the importance of continually evaluating the uses and effectiveness of recently renovated spaces.¹⁴ By returning to design principles grounded in deeper learning principles, learning space evaluators have a means to determine the success of current and future space.

Finally, we hope that we have engendered a spirit of adventure in looking at and discussing how space can be utilized to bring about deeper learning. Or, to put this another way, we quote Mark Twain: “Twenty years from now you will be more disappointed by the things you didn’t do than by the ones you did do. So throw off the bowlines. Sail away from the safe harbor. Catch the trade winds in your sails. Explore. Dream. Discover.”^e

Notes

1. Malcolm Brown, “Learning Spaces,” in *Educating the Net Gen*, ed. Diana G. Oblinger and James L. Oblinger (Boulder, Colo.: EDUCAUSE, 2005), 12.3, e-book, available at <<http://www.educause.edu/LearningSpaces/6072>>.
2. This term was coined by Marc Prensky: “Digital Natives, Digital Immigrants,” *On the Horizon*, vol. 9, no. 5 (October 2001), <<http://www.marcprensky.com/writing/Prensky%20-%20Digital%20Natives,%20Digital%20Immigrants%20-%20Part1.pdf>>.
3. Brown, “Learning Spaces,” 12.4.
4. Phillip Long is senior strategist for academic computing at MIT, and Ed Crawley is the former head of the Aeronautical/Astronautical Department of MIT. The CDIO process was used in the renovation of the Aero/Astro building at MIT: <<http://web.mit.edu/aeroastro/www/about/facilities/learninglaboratory.html>>. See Christopher G. Johnson and Phillip D. Long, “Learning Space Design,” presentation at the EDUCAUSE Annual Conference, Denver, Colorado, October 21, 2004, <http://www.educause.edu/content.asp?page_id=666&ID=EDU04124&bhcp=1>. For more on the CDIO process, see <<http://www.cdio.org/index.html>>.
5. National Research Council, John D. Bransford et al., eds., *How People Learn: Brain, Mind, Experience, and School*, expanded ed. (Washington, D.C.: National Academy Press, 2000).
6. Colleen Carmean and Jeremy Haefner, “Mind over Matter: Transforming Course Management Systems

into Effective Learning Environments,” *EDUCAUSE Review*, vol. 37, no. 6 (November/December 2002): 29, <<http://www.educause.edu/ir/library/pdf/erm0261.pdf>>.

7. Arthur W. Chickering and Zelda F. Gamson, “Seven Principles for Good Practice in Undergraduate Education,” *AAHE Bulletin*, March 1987, <<http://aahebulletin.com/public/archive/sevenprinciples1987.asp>>; National Research Council, M. Suzanne Donovan and John D. Bransford, eds., *How Students Learn: History, Mathematics, and Science in the Classroom* (Washington, D.C.: National Academies Press, 2005); National Research Council, James W. Pellegrino, Naomi Chudowsky, and Robert Glaser, eds., *Knowing What Students Know: The Science and Design of Educational Assessment* (Washington, D.C.: National Academy Press, 2001); Oblinger and Oblinger, *Educating the Net Generation*, <<http://www.educause.edu/educatingthenetgen>>.
8. Diana Oblinger and James Oblinger, “Is It Age or IT: First Steps toward Understanding the Net Generation,” in Oblinger and Oblinger, *Educating the Net Generation*, <<http://www.educause.edu/IsItAgeOrIT/6058>>.
9. Prensky, “Digital Natives, Digital Immigrants.”
10. Chickering and Gamson, “Seven Principles for Good Practice in Undergraduate Education.”
11. Learner-Centered Principles Work Group, American Psychological Association Board of Educational Affairs, “Learner-Centered Psychological Principles: A Framework for School Reform and Redesign,” 1997, <<http://www.apa.org/ed/lcpnewtext.html>>.
12. Ibid.
13. The development of design principles and the examples described here are based on work begun at the NLIH 2004 Fall Focus Session—“Learning Space Design for the 21st Century”—held in Cambridge, Massachusetts.
14. Dan Gilbert, Christopher G. Johnson, and Phillip D. Long, “Learning Space Design,” presentation at the NLIH Annual Conference, San Diego, California, January 27, 2004, <<http://www.educause.edu/librarydetailpage/666?id=nli0427>>.

If you are interested in finding out more about learning space design, see the EDUCAUSE Learning Initiative (formerly the NLIH) Learning Space Design Web page: <<http://www.educause.edu/LearningSpace/942>>. If you would like to participate in a conversation on learning space design, see the EDUCAUSE Learning Space Design Constituent Group: <<http://www.educause.edu/cg/learningspace>>. On September 14–15, 2005, the EDUCAUSE Learning Initiative will hold a focus session—“Design of Informal Learning Spaces”—at Estrella Mountain Community College in Avondale, Arizona; see <<http://www.educause.edu/eli054>>.