Learning Spaces

Diana G. Oblinger, Editor

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CHAPTER 6

The Psychology of Learning Environments

Ken A. Graetz
Winona State University

> He emerged into the strangest-looking classroom he had ever seen. In fact, it didn't look like a classroom at all, more like a cross between someone's attic and an old-fashioned tea shop. At least twenty small, circular tables were crammed inside it, all surrounded by chintz armchairs and fat little poufs. Everything was lit with a dim, crimson light; the curtains at the windows were all closed, and the many lamps were draped with red scarves. It was stiflingly warm, and the fire that was burning under the crowded mantelpiece was giving off a heavy, sickly sort of perfume as it heated a large copper kettle. The shelves running around the circular walls were crammed with dusty-looking feathers, stubs of candles, many packs of tattered playing cards, countless silvery crystal balls, and a huge array of teacups.[1]

The Environmental Psychology of Teaching and Learning

This enchanting description of a classroom at the fictitious Hogwarts School of Witchcraft and Wizardry captures three fundamental ideas from the environmental psychology of teaching and learning. First, all learning takes place in a physical environment with quantifiable and perceptible physical characteristics. Whether sitting in a large lecture hall, underneath a tree, or in front of a computer screen, students are engulfed by environmental information. Specific targets within the environment draw the students' attention, such as armchairs, scarves, and teacups, and they continuously monitor the ambient properties such as the light of the lamps, the smell of the kettle, and the warmth of the fire. In any learning environment students are awash in environmental information, only a small fraction of which constitutes the sights and sounds of instruction.

Second, students do not touch, see, or hear passively; they feel, look, and listen actively. Students cannot attend to all the environmental information bombarding them at any given time; their ability to gather and understand incoming information is limited. Through automatic and controlled processes, students select information for consideration. They try to understand what they are sensing by piecing bits of information together from the bottom up and by applying existing thoughts and preconceptions from the top down. A classroom with circular tables and comfortable armchairs may look strange because it deviates from expectations formed through prior experience. Students may direct their attention to particular targets in the learning environment that they find more interesting, important, or unfamiliar than others. For some, it might be the instructor's engaging chemistry demonstration. For others, it may be the silvery crystal ball on the shelf. In any learning environment, students manage their limited cognitive resources by actively selecting environmental information for further consideration and by using existing knowledge structures to interpret this information in ways that have worked previously.

Third, the physical characteristics of learning environments can affect learners emotionally, with important cognitive and behavioral consequences. Although emotional reactions to environmental stimuli have been shown to vary widely across individuals and activities, most students would probably find learning difficult in a classroom that is stiflingly warm. Conversely, environments that elicit positive emotional responses may lead not only to enhanced learning but also to a powerful, emotional attachment to that space. It may become a place where students love to learn, a place they seek out when they wish to learn, and a place they remember fondly when they reflect on their learning experiences. In higher education, we hope to provide such places for our students to learn, even as we build yet another large lecture hall and attempt to squeeze our students into crowded, noisy, and uncomfortable spaces. Clearly, some learning environments are more comfortable and offer fewer distractions than others. In any learning environment, physical characteristics that cause discomfort can be expected to interfere with learning; environments that produce positive emotional states can be expected to facilitate learning and the development of place attachment.

The areas of psychology that relate most directly to classroom design and learning environments are environmental, educational, human factors (engineering), and social psychology. Previous research on the effects of such environmental variables as light, temperature, and noise on learning has yielded some predictable results that are addressed through traditional classroom design. Learning appears to be affected adversely by inadequate light, extreme temperatures, and loud noises—variables maintained within acceptable ranges in most college classrooms. Other results, however, reflect the often complex, subtle, and surprising interplay between the learner and the learning environment. Years of research on the impact of environmental variables on human thoughts, feelings, and behaviors indicate that other variables often moderate the effects of environmental variables. In a summary of the research on educational environments, Weinstein[2] concluded that environmental variables can impact learners indirectly and that the effects of different physical settings often depend on the nature of the task and the learner. For example, distracting noises appear to slow reaction time and degrade performance to a greater degree in older versus younger adults[3] and for introverts to a greater degree than extraverts.[4]

Research on the impact of information technology on learning environments is not as voluminous. The presence and application of technology changes the learning environment, both directly and indirectly. This chapter focuses on the psychological underpinnings of three such changes with major implications for the design of college learning environments:

- the increased presence of personal, networked devices (for example, wireless laptops and cellular phones) in the classroom,
- the migration of course content to the Web and the subsequent transition in classroom activity from information delivery to collaboration, and
- the increasing importance of virtual learning environments.

Devices and Distraction in College Classrooms

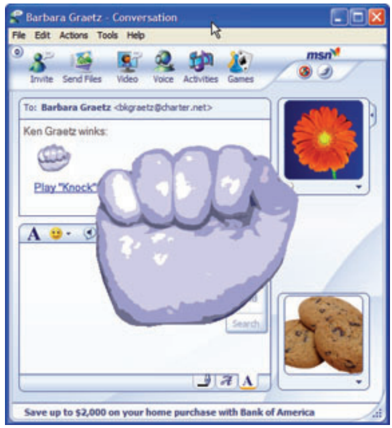
Laptops and other mobile devices have great potential to enhance and transform instruction and are being used effectively in many college classrooms.[5] Today's students use their devices in class to take notes, access materials and applications, and find relevant information. When all students in a classroom can access networked tools simultaneously, many collaborative learning and just-in-time teaching opportunities emerge. There is a dark side to the presence of personal, networked devices in class, however—when students use them to engage in activities unrelated to coursework.

Students have always found ways, other than listening to the instructor, to pass the time during class. Crossword puzzles, doodling, and daydreams have occupied students' minds during more classes than we care to admit. At first glance, it appears that the wireless laptop, PDA, iPod, and cellular phone are simply the crossword puzzles of today's college classrooms. As suggested by the comments below, however, the issue is more complex. Yesterday's students did not have 24 × 7 online access to all of the content presented during a typical lecture-based class, did not find the crossword puzzle being tackled by the student sitting next to them particularly distracting, and were not themselves as tempted by a crossword puzzle as by instant messaging or an immersive online game. In addition, a handful of students in a large lecture hall working on crossword puzzles did not change the physical environment for instructors:

> When a teacher is up there reading his slides and I can go home and look at them later, Solitaire can be a temptation—let alone my e-mail messages that I'm checking. It's kind of a blunt truth, but sitting in the back of the classroom, it's not just me. You look around and all you see is Solitaire, e-mail.[6]
>
> The computers interfere with making eye contact. You've got this picket fence between you and the students.[7]

In addition to the sensory richness of Web sites and online games, today's mobile devices convey social information, one of the most powerful targets of attention. We seem particularly attuned to this information, whether studying people's faces and body movements or listening to people talk. In addition, the software applications used to mediate communication are designed to grab the user's attention. Microsoft MSN Messenger, a popular instant messaging client, provides a visible and audible signal when a member of your buddy list starts the application and when a message is received. It has a "nudge" feature that presents a distinctive sound and animation when you want to attract the attention of a buddy, shaking the messaging window back and forth on the buddy's screen. It has a "wink" feature that allows you to send animations to a buddy, such as the large set of knuckles illustrated in Figure 1 that appear to rap on the inside of your buddy's screen. Even if students make every effort to pay attention to the instructor, instant messaging applications are designed to capture their attention, and the social information conveyed is probably too alluring for most students to ignore.

Figure 1. MSN Messenger "Wink"



To better understand the potential of today's mobile devices to distract students, it may be helpful to review some of the basic principles of attention.[8] Attention is perhaps best represented not as a single process but as an organized set of procedures through which we select specific environmental stimuli or inputs for cognitive processing.[9] It is commonly held that only one input is processed consciously. This could be called the *attended input*. All other environmental stimuli (for example, background noise, the temperature of the room) are processed unconsciously. These are the *unattended inputs*. Unconscious monitoring detects changes in inputs to which we are not attending consciously, but that might be important. What constitutes an important change is probably determined by another process, referred to here as the *attention controller*, which may push the information into conscious awareness.[10] This might result in the selection of a new attended input, a shift in attention perceived as either controlled and selective or unexpected and distracting.

We have all experienced the sudden conscious awareness of an unattended input. The so-called cocktail party effect[11] occurs when you hear your name mentioned somewhere in a crowded room as you engage in a discussion with someone else. Even as you attend to the discussion, presumably you monitor other sounds in the room unconsciously. Your attention controller detects an important stimulus—your name—which causes you to shift your conscious attention away from your discussion.

Using these basic concepts, the distracting nature of mobile devices in the classroom can be recast. Given two potential inputs, the instructor or a laptop screen displaying a game of Solitaire, some students select the instructor as the attended input and the laptop as the unattended input. Those who are trying to listen to their instructor and find their attention captured by their own or another student's laptop screen are distracted by that device. This can be problematic in a classroom environment, as it interferes with students' ability to process course-related information and prevents them from obtaining an outcome (specifically, learning) they desire and expect to receive, a common cause of frustration, anger, and aggression.[12] This emotional response is probably more pronounced when students are distracted by others' devices over which they have no control.

As much as we hope that all students select their instructors as the primary target of their attention during class, we know that some choose the game of Solitaire, relegating the instructor to the status of unattended input. This is often described erroneously as distraction. In fact, these students are not distracted by their devices; they have selected them for attention. If anything, these students may find themselves distracted by the instructor. This is probably what passes as multitasking for many students. They attend to e-mail, instant messages, and other unrelated, device-based information during class, while monitoring the instructional stream unconsciously. Their attention controllers are set to respond to important signals, such as the phrase, "This will be on the test." In the classroom version of the cocktail party effect, students' attention then snaps to the instructor.

Although the challenge in this case is one of student motivation, not distraction, the two are closely related. As more students decide to instant message or play online games during class, the volume and variety of potentially distracting environmental information increases, making it more difficult for motivated learners to attend to the instructor. What impact does this have on classroom design? First and foremost, instructors must be able to engage students in the learning process during class time, and classrooms must be designed to facilitate that engagement. It is difficult for students to attend to other activities when they are talking to an instructor, working on a group activity, or using their devices for academic purposes. Instead of banning instant messaging in class, instructors might be supported in their use of this and other social technologies to facilitate class-related discussion and collaborative work.

Attempting to prohibit the use of devices in class through edict or infrastructure (for example, installing an Internet kill switch) is costly and does little to address the underlying problem. It is preferable to design classrooms and classroom computing policies that allow instructors to exercise greater social control. In the case of laptops in the classroom, screens should be easily visible to instructors as they walk around the room, and instructors should be able to display any student's laptop screen to a public screen at a moment's notice. In large classes, software that allows instructors to view thumbnail images of each student's screen (for example, DyKnow Monitor or SMART SynchronEyes) may also be useful. Although most instructors are probably not interested in spending time on what feels like student surveillance, the mere presence of these methods combined with clear classroom policies offers a good classroom management solution that lets students continue using their devices for academic purposes.

Through their behavior, some students are telling us that they feel neither the need nor the desire to pay close attention to the instructor during some classes. Generally speaking, this is nothing new. However, those responsible for designing learning spaces should be aware that today's incarnation of this problem requires additional study. Today's devices are colliding with yesterday's methods. What takes place in a college classroom is changing, due in large part to the very information technology that gives some instructors and administrators cause for concern. The classroom is no longer a place where information is delivered to passive students. A growing number of students get that information elsewhere and do not expect to hear it repeated verbatim in class. Instead, the classroom is becoming an interactive, collaborative environment where knowledge is created actively by students, many of whom have devices that are as much a part of them as their own skin and that can be a very important part of this process.

Collaboration in the Classroom

Although planning for data projection and network access is an important part of today's classroom design process, information technology is likely to have an even greater indirect effect on how fixed-site classrooms are used in the future. The migration to the Web of the content traditionally delivered by instructors in lecture format is helping shift the function served by brick-and-mortar classrooms from information delivery to collaboration and discussion. Collaborative learning refers to a wide variety of "educational activities in which human relationships are the key to welfare, achievement, and mastery," wherein faculty "help students learn by working together on substantive issues."[13] Surveys indicate that lecture is still the most common instructional method used by college educators in the United States.[14] Nonetheless, the transition from lecture to collaboration is well under way.

What impact does this have on classroom design? This fundamental change will challenge designers to create environments that facilitate collaborative activities. Instead of theaters where students watch instructors perform, classrooms must be flexible meeting places. Bruffee[15] described the ideal classroom for collaborative learning:

> A level floor, movable seats, chalkboards on three or four walls, controlled acoustics (acoustical-tiled ceilings and carpeted floors), and no central seminar table (or one that can be pushed well out of the way without threatening an attack of lumbago). An alternative is six to ten movable four- or five-sided tables of roughly card-table size.

This description implies a maximum class size of 50 students. The question of classroom density is an important one: Researchers have explored the psychological and educational effects of classroom density, both spatial (the size of the room) and social (the number of students). In their meta-analysis of 77 different studies on this issue, Glass and Smith[16] concluded that higher social density results in lower student achievement. When designing collaborative classrooms, a good social density benchmark is three to five groups of 6 to 12 students each. Spatial density should be such that both students and instructors have enough room to move easily from group to group (specifically, 4 to 7 feet between groups). Designers should also pay careful attention to the degree to which students feel crowded in a classroom. The experience of crowding in educational settings appears related to personal space violation.[17] Research suggests that groups of students can be expected to work together most effectively at personal distances of 2 to 4 feet without feeling crowded.

Although class size is a limiting factor when implementing certain collaborative learning activities comfortably, small group collaboration and discussion are easier to manage in large classes than many instructors realize. Informal small group techniques like think-pair-share,[18] wherein students think briefly about a question posed by the instructor, discuss their thoughts with a student sitting next to them, and then share their joint thoughts with the class, are feasible in large classes[19] and can be facilitated by technology. More formal activities such as jigsaw groups and structured controversy can also engage students in large classes.[20]

Classroom response systems or "clickers" are used by a growing number of instructors to gather student feedback and stimulate in-class discussion. In classes that allow group network access, a wide variety of groupware tools can support collaboration in groups of all sizes. DyKnow Vision allows students to view and annotate instructor whiteboard activity in real time. Instructors can then invite students to the virtual whiteboard, displaying their work to the entire class. GroupSystems is a suite of tools for supporting idea generation, organization, and evaluation in face-to-face and distributed groups.

Virtual Learning Environments

Today's students spend an increasing amount of their time peering at computer screens. These virtual environments have physical characteristics that are just as real as those of a dormitory room or a brick-and-mortar classroom, and students can become just as attached to them. On one end of the continuum are virtual worlds that emulate a natural, multidimensional environment. Many students subscribe to massive multiplayer online games such as *World of Warcraft*, wherein they develop personas or "avatars," travel from town to town, acquire property, meet other people, and solve problems. On the other end of the spectrum are the online work spaces that students use every day, such as course management systems and campus portals. Somewhere in between are applications such as Facebook and MySpace, or persistent, customizable, social spaces that lack the immersive qualities of virtual worlds but are more open, recreational, and social than campus work spaces.

Although many administrators and instructors are familiar with course management systems and campus portals, fewer have experience with virtual worlds and may question their academic relevance. A good example of a virtual world used as a classroom is *Second Life*, an online environment designed to support creativity, collaboration, commerce, and entertainment. Although members can play games in world, the environment itself is not a game in the traditional sense. Instead, it is an open environment (what some call synthetic reality) where members can interact with each other and build things (for example, buildings, games, clothing, furniture) for use within the virtual world. A growing community of educators uses *Second Life* for instructional purposes. In fall 2005, the School of Architecture at The University of Texas at Austin used *Second Life* in the course Designing Digital Communities, and Southern New Hampshire University used it in Introduction to International Business. Figure 2 shows a snapshot of my *Second Life* avatar, Hoptoad Flan, enjoying a relaxing moment.

Figure 2. *Second Life* Avatar Hoptoad Flan

What impact does this have on classroom design? First, campuses can expect the boundaries between virtual and brick-and-mortar learning environments to continue to blur. Students and instructors will need access to their virtual learning environments while seated in their brick-and-mortar classrooms. Second, as campuses accept the notion that virtual spaces are actually classrooms, they can begin to apply the same care and consideration to decisions about course management systems and campus portals as they do to decisions about new construction and renovation. Of utmost importance is the usability of these virtual spaces.

A popular model of usability[21] identifies five criteria for defining a usable system:

- *Learnability* refers to the speed and ease with which a novice user can achieve proficiency with the system.
- *Efficiency* refers to the degree to which the system supports the performance of an experienced user in the shortest amount of time and with the fewest steps.
- *Memorability* refers to the degree to which a user, particularly an intermittent or casual user, can remember how to accomplish a task using the system, the steps of which were learned previously.
- *Errors* refer to the number of mistakes and missteps made by users.
- *Satisfaction* refers to the users' overall emotional experience when using the system.

Careful, objective usability analyses of common digital environments should be conducted and problems should be addressed using similar decision-making processes and with the same sense of urgency that campuses apply when addressing poor conditions in brick-and-mortar classrooms.

College Classrooms of Mystery and Enchantment

As students enter a virtual or brick-and-mortar learning environment, they form a cognitive impression of that space and experience an associated emotional response, just as Harry Potter did when he entered his Divination classroom. People's preference for specific environments appears to depend on their cognitive impression. Kaplan and Kaplan[22] suggested four cognitive determinants of environmental preference:

- *Coherence,* or the ease with which a setting can be organized cognitively
- *Complexity,* or the perceived capacity of the setting to occupy interest and stimulate activity
- *Legibility,* or perceived ease of use
- *Mystery,* or the perception that entering the setting would lead to increased learning, interaction, or interest

An interesting addition to this list might be the concept of *enchantment*. Bennett[23] described enchantment as the experience of being "both caught up and carried away." When enchanted by what we are experiencing, we are held spellbound, our senses seem heightened,[24] and we are caught in a moment of pure presence that we try to maintain.[25]

Students probably find today's brick-and-mortar college classrooms quite coherent and legible. They make perfect sense to those who expect to sit, facing forward, and listen quietly. Virtual learning environments may lack some of this coherence and legibility but are probably perceived as more complex and mysterious. What of enchantment? Our students are enchanted by works of art, musical performances, and breathtaking landscapes, but do they find our learning environments enchanting? We can all recall our favorite classroom and our favorite place to study as students. We all relate to Harry Potter walking into a classroom on the first day of school and experiencing a sense of awe and wonder at the feathers, stubs of candles, packs of tattered playing cards, and silvery crystal balls on the shelves. It is possible to build learning environments from both brick-and-mortar and bits-and-bytes that draw students in and elicit a sense of mystery and enchantment. As we respond to the increased presence of networked devices, the transition from lecture to collaboration, and the growing importance of virtual environments and build the classrooms of the future that facilitate usability, engagement, collaboration, and learning, we would do well to remember what it was about learning environments that enchanted us and commit ourselves to preserving, restoring, and creating those experiences for our own students.

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About the Author

Ken A. Graetz is the director of e-learning at Winona State University, where he is engaged in the development of learning opportunities for WSU faculty and staff members, e-learning project management and support, and numerous research and development projects. His research interests include team and group dynamics, social cognition, psychometrics, and computer-supported collaborative work. Graetz received a PhD in psychology from the University of North Carolina at Chapel Hill in 1992.

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info@educause.edu
1150 18th Street, NW, Suite 1010
Washington, DC 20036
202-872-4200
202-872-4318 (fax)

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Boulder, CO 80301-2538
303-449-4430
303-440-0461 (fax)