Interaction: Principles and Practice

Executive Summary

This report, based on the 2005 Summer Focus Session conducted by the EDUCAUSE Learning Initiative (ELI), discusses the importance of aligning teaching and learning to the basic principles of *how* people learn. It argues that the degree of interactivity featured in course content delivery has a strong impact on successful learning. Several models of interactivity are presented. The report features an overview of those institutional resources that must be considered in the establishment of interactive learning environments. It concludes with a pragmatic discussion on how supporters of these interactive learning environment efforts can "make the case" to institutional decision makers.

Introduction

Interaction is closely linked to successful learning; interacting with others or with information can help clarify concepts, improve problem solving, and enhance retention. While the simplest form of interaction may be questions and answers, a variety of interaction models exist.

Net Generation college students have grown up in a highly interactive environment, often resulting in the expectation that learning will be interactive, as are other aspects of their lives. The critical point is not that the technology is important; it is how that technology can facilitate interaction—not just because students crave it but because it leads to improved learning.

Institutions that commit to increasing interaction also commit themselves to provide faculty development, staff support, technological infrastructure, and assessment that support interactive learning. They may find student input and feedback are critical components as well.

This paper synthesizes the results of a meeting focused on improving classroom interaction with technology (see the appendix).

How People Learn

Any attempt to design and develop new learning environments for students must be grounded in an understanding of how people learn. Learning is an interactive process in which the learner develops his or her own understanding by assembling facts, experiences, and practices. Learning also depends on participation; it is part cerebral and part social.

There are five critical components to consider in how people learn:

- **Preconceptions:** All learners have preconceptions, attitudes, beliefs—and sometimes incorrect information. When constructing learning, it is important to ensure that a learner has a solid foundation, taking time to correct misconceptions. For example, concept inventories used with student response units can help both students and faculty identify misconceptions.

- **Facts:** In constructing learning, facts matter. Content can come from books, lectures, or the Web.

- **Context:** Facts and experiences are more likely to be remembered when placed in context—and in relationship to each other. IT allows learners to identify familiar contexts or ones that are of interest to them.

- **Application and use:** Knowing and understanding are different; a student understands a concept, skill or theory when he or she can apply it to a new situation.[1] By applying new information—through problem sets, case studies, game-based applications, or simulations— learners can transfer learning from one situation to another. Studies have demonstrated that combining hands-on experiences with opportunities for reflection leads to deeper learning.

- **Metacognition:** Understanding how one learns—and being able to self-correct—helps a learner move from being a novice to an expert. People not only learn *from* experience; they also learn *to* experience—noticing things they may have missed the first time. It is the dynamic, ongoing interplay between learning *to* experience and learning *from* experience that develops expertise.[2] One emerging technology that can capture this growth is e-portfolios. E-portfolios have the potential to allow students to review *what* they have learned and *how* they learned it.

Models for Interaction

There are several models for interactivity in the classroom. All predate the use of IT in the classroom; however, IT makes it easier to create and sustain interaction. Examples include:

- **Person to information:** These models connect students to the source of information. For example, numerous digital archives contain in-depth information on a wide variety of subjects and often include rich media such as images, video, and sound clips as well as text. For example, *The Valley of the Shadow* (http://valley.vcdh.virginia.edu) is a digital archive of actual artifacts on the Civil War. Simulations are a person-to-information model. For example, natural phenomena can be illustrated using animations (see <http://workbench.concord.edu>). Practice and feedback can be interactive. LON-CAPA features a wide variety of individualized problems (in physics, astronomy, chemistry, biology, mathematics, statistics and geology), along with feedback. The system creates and grades randomized homework, quizzes, or exams, reducing and "blind" copying of answers; the system gives a different version of the problem to each student (see <www.lon-capa.org/>).

- **Serious games:** Games are an inherently visual and interactive medium, one that most Net Generation learners are familiar with. Game-based educational applications are emerging in a variety of subjects. For example, an historical game requires students to use social, economic, political, and other variables to govern pre–World War II Europe.

- **Virtual laboratories:** These applications allow students to conduct simulated experiments without the expense, and potential danger, of physical labs. By allowing students to set up experiments, and gather data, as well as interpret and analyze the results, virtual labs increase interactivity and individualization compared to a traditional laboratory.

- **Peer-to-peer:** Students learn with—and from—each other in peer-to-peer models, either virtually or face-to-face. Blogs and wikis can be peer-to-peer models that promote literacy through writing and storytelling. Students write about and edit each other's work.

- **Peer-led team teaching:** This model uses study groups led by specially trained students, allowing learners to interact and learn from each other. For example, DePauw University's START program (http://www.depauw.edu/it/start/) features active instructional participation by seniors who have spent three years in the program. These peer team leaders are excellent role models for those students who are just entering the program.

- **SCALE-UP:** This highly interactive, hands-on environment for large enrollment classes (www.ncsu.edu/per/scaleup.html) emphasizes student-to-student and student-to-faculty collaboration. The students work teams of three to solve problems, both tangibles (hands-on) and ponderables (conceptual). In addition, SCALE-UP's classroom design enables collaboration and problem solving.

- **Calibrated Peer Review (CPR):** This Web-delivered comprehensive writing and critical-thinking instructional tool (http://cpr.molsci.ucla.edu/) not only promotes student understanding through writing but also develops a student's critical-thinking skills through the process of peer evaluation and review. Based on a research-based peer-review model, CPR helps students not only learn to write, but write to learn. Because the Web-based and computer-managed program uses a peer-review process, faculty can use CPR with any size class. Students have the flexibility to work on their assignments wherever they have Internet access.

- **Response-centered teaching:** These applications adjust the rate and difficulty of content to students' understanding. Models such as "just-in-time teaching" do not use information technology; other applications are online, such as inserted self-evaluations that must be successfully completed before more content is presented. Clickers or student response systems can also be used to gauge the level of student understanding.

- **Problem-based learning:** Although students can be asked to solve problems in almost any situation, there are specific models of interaction designed around problem-solving. In problem-based learning (PBL) students are given a problem to solve; they must organize ideas, discuss their knowledge, refine their approach to the problem, and solve it. Interaction is involved throughout; students pose the questions, identify aspects of the problem they do not understand, seek guidance, and refine their work.

Although not exhaustive, the list illustrates alternative models that can be used to increase interactivity and student learning.

Key Considerations in Building Interactive Learning Environments

Interactive learning environment are not created by chance. Institutions committed to interactive learning typically invest in a number of enablers. These include:

- **Leadership commitment:** Is the institution committed to student success and interactivity? Do individuals in critical decision-making positions actively articulate their commitment and assign resources to support interactivity? Are interactivity and improved learning recognized and rewarded?

- **Faculty development:** What skills, perspectives, and support do faculty need to adopt interactive models that improve student learning and engagement? What is the role of IT in supporting this process?

- **Technology infrastructure:** What underlying technical components (networks, servers, routers, and development tools) are needed to support interactive learning? Can the existing infrastructure be adapted to new models of interaction?

- **Learning spaces:** Learning takes place in many different environments—formal, informal, and virtual. How can space configuration enable interaction and a better learning experience?

- **Instructional support:** What type of technical assistance, instructional design, or graphic design is needed to move interactive models into practice?

- **Assessment:** What measures should be adopted to track the effectiveness of interactive instruction? How should institutions evaluate successes and failures? How can these evaluations be used to encourage ongoing improvement?

- **Student input:** Students often have a unique and valuable perspective on interactive learning environments. Can faculty and administrators gain valuable insight into what will work, and what won't, from the students' perspective?

Leadership Commitment

Implementing an institution-wide program that encourages interactivity requires the support, cooperation, and commitment of a wide variety of individuals, especially institutional leaders because of their ability to articulate vision, assign resources, encourage broad support, and provide rewards and recognition. Leadership may also be displayed by tenure and promotion committees who recognize the contributions of faculty who have introduced additional interactivity into their courses. Changes in tenure and promotion—determined by the faculty—may change the institutional climate for experimentation and commitment to interactive learning.

Communication

Creating and sustaining interactive learning environments requires communication—about goals, approaches, and results. Even in the planning stages, there is the need to communicate openly, effectively, and frequently with all stakeholders. The failure to communicate goals, issues, and results leads to less effective planning and implementation.

Faculty Development

For classes to be more interactive, faculty must be comfortable with interactive pedagogies and technologies. These interactive models likely have not been part of their formal training or personal experience. As a result, faculty development programs are necessary to encourage faculty to integrate alternative teaching and learning models and technology into their classes. Faculty development helps individuals develop confidence in interactive instruction and the benefits of that investment. Options for faculty development include:

- classes for faculty;
- drop-in technical consulting staff;
- assignment of qualified student assistants;
- travel support for faculty to attend relevant conferences and workshops;
- access to development labs—places where faculty can test-drive emerging technologies; and
- joint faculty-student fellowships to develop interactive materials.

Technology Infrastructure

Many interactive models are facilitated by technology, as in the communication and collaboration surrounding most teaching and learning environments. As a result, a solid technology infrastructure is often a prerequisite for interactive teaching and learning. The infrastructure goes beyond networks, e-mail, and course management systems to include classroom devices such as student response systems (aka clickers).

Learning Spaces

The physical environment in which learning occurs—learning spaces—changes as educational technology and pedagogy matures. Space can inhibit—or enable—interaction. Roundtables promote

group work; chairs that are bolted to the floor, all facing the front of the room do not. Alternative models for classrooms, labs, and gathering places can enhance student interaction.

Moving from traditional to more interactive classroom spaces raise new considerations in design, development, and implementation, such as:

- Who needs to be involved in decisions about interactive learning and the spaces in which it occurs? Does the discussion of learning occur prior to the space design?
- Are space discussions limited to classrooms, or do they include informal and virtual environments?
- Are spaces flexible so that their design can change as new models of interaction emerge?
- Are learning spaces compliant with various federal and state requirements, such as the Americans with Disabilities Act (ADA)? Are they ergonomically and aesthetically well designed?

Instructional Support

Ongoing faculty support is crucial for the adoption of new teaching techniques such as interaction. Faculty need time and support to become comfortable with interactive models—particularly faculty who are uncomfortable in an IT environment. Instructional support (instructional design, technical assistance, graphic design, and so on) can help faculty redesign courses resulting in learning that is more interactive and engaging. Ongoing instructional support is predicated on an adequate funding base, well-trained staff, and flexible assistance (for example, over-the-phone troubleshooting and student assistants).

Support services must be scalable. As more interactive models are adopted, demand for instructional support, training, and ongoing support will increase.

Assessment

Tracking and evaluating the impact of interactivity can inform and energize subsequent efforts. Assessment is important to ongoing improvement as well as to the justification of new or different resources. It also provides data that may be useful in tenure, promotion, and merit decisions. A variety of assessment strategies may be useful:

- Alignment of institutional mission and goals
- Assessment of instructional design and implementation
- Assessment across courses and curricula
- External assessments
- Student course assessment

Fundamentally, all assessment activities should consider how well (or how poorly) the interaction meets course objectives and specific learning outcomes. There is a difference between how much students *like* the course and how much they *learn* in the course.

Student Input

Students have a valuable perspective on how interactive experiences enhance their learning and engagement. Students have a unique view of interactive technologies—they use them daily; this use shapes their expectations.

Students can provide a powerful voice for those who want to try a new instructional approach. Student feedback can justify new projects, give them legitimacy, and make it easier to justify the necessary resources.

Making the Case: Obtaining Institutional Buy-In and Support

One of the most challenging tasks facing those advocating interactive learning approaches is how to win support for their project—both from faculty and administrators. Making the case for institutional support of interactive learning is critical.

An early step is assessing the receptivity of institutional leaders to interactive learning. Communicating the benefits of interaction, linking it to institutional mission and goals will help establish interaction as a priority rather than just another idea. Administrators need to be involved in key decisions such as goals, design, funding, infrastructure, and support. While involving senior administrators, don't forget to communicate broadly; it takes a range of stakeholders to ensure interactive learning is successful and sustainable.

Some of the most important items to consider when making the case for interaction include.

- **Do your homework.** Institutions are experimenting with a wide variety of interactive models. Learn about those efforts, including success, limitations, and implementation issues. When possible, select examples from peer institutions to ensure stakeholders see the relevance to your institution. Seek examples and contacts through professional organizations such as the ELI.

- **Choose a primary audience.** Decide to whom the case must be made and made well—such as the provost, vice chancellor, dean, department chair, board of trustees, or faculty. Determine the significant influences and make sure that they are well-informed. Try to position interaction from their perspective and how it meets the institution's needs.

- **Relate interaction to a key institutional priority.** Describe the problem that interactive learning will solve. Stakeholders need to see a return on their investment. Such returns can be measured in terms of achieving economies of scale, greater instructional efficiencies, student recruitment, or student retention. Emphasize how interaction can improve classes and enhance the student experience. Also consider student outcomes such as critical thinking, collaboration, or innovation.

- **Describe the critical success factors**. These include the risks inherent in the project as well as what is needed to make the program successful. Include required resources such as staff, funding, space, and equipment. Go beyond resources to describe steps that will mitigate risks (for example, lack of faculty buy-in). Build on the lessons others have learned, such as the importance of a communication plan or tailoring the approach based on institutional culture. Anticipate the inevitable question of sustainability and describe funding and personnel issues as well as potential economies of scale.

- **Make the assessment strategy clear.** From a one year proof-of-concept to a multiyear implementation, build assessment into the plan. Periodic assessments document successes and foster an understanding of the value of the program to the institution; assessments also support requests for program enhancements or redirection.

Summary

Interactivity can stimulate and challenge students, increasing their learning. Models of interaction range from simple, nontechnical"approaches—roundtables, for example—to sophisticated programs such as CPR and LON-CAPA. These alternative models emphasize student-to-student and student-to-faculty interaction.

Because successful learning is part of all institutions' missions, a strong case can be made for increasing interaction. Introducing interaction into the teaching and learning is an iterative process that requires input from students, faculty, support staff, and university administrators. Implementation requires careful consideration of stakeholders, institutional culture, and the enablers of change.

Endnotes

1. Wendy Rickard and Diana Oblinger, "Unlocking the Potential of Gaming Technology," Microsoft Higher Education Leaders Symposium 2003, <http://www.educause.edu/ir/library/pdf/NLI0425.pdf>.

2. Ibid.

Appendix: Structure and Format of the Focus Session

This report represents a synthesis of the EDUCAUSE Learning Initiative (ELI) Summer Focus Session, "Rethinking the Classroom: Designs for Interaction," held June 15–16, 2005, on the campus of Michigan State University in East Lansing, Michigan. More than 90 participants, representing colleges and universities faculty, students, IT staff, and administrators came together to discuss and explore new ways to invigorate the teaching and learning experience by using techniques that feature high levels of student interactivity.

ELI's Summer Focus Session showcased how, when, and under what circumstances universities should consider designing and developing interactive learning environments. Using facilitated group discussions, brainstorming sessions, and small group activities, the two-day session served to highlight how the ubiquitous availability of Web-based and Internet facilitated technologies can (or should) be integrated into an enriching teaching and learning experience.