

Five Ways Technology Can Enhance Teaching and Learning in Higher Education

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Purpose of the Study: To investigate who at the university (Brigham Young University) was using technology in ways that seemed to be effective and start to identify patterns for how they were using these tools, and to achieve what purposes. This study was published in *Educational Technology*¹, and is intended to be the beginning for more in-depth studies later on.

Methodology: Requested recommendations from department chairs and campus instructional designers for instructors who used technologies in “innovative ways.” Received 135 recommendations, which were narrowed by surveying these instructors and asking about the technologies and instructional methods they used. Interviewed 35 instructors representing nearly every college on campus. These interviews were selected based on our interpretations of the uniqueness of the cases, and the perceptions the instructors had that the technologies were helping to enhance their instruction.

Limitations: This was a small sample size, and the sample was selected based on the perceptions of the researchers about what seemed to be unique, or innovative. Thus, it is best considered to be a pilot study of some of the interesting things that can be done with technology in some contexts, and not be generalized to a much greater extent.

Findings: We identified five patterns for how instructors were using technology to enhance their teaching.

1. **Visualization**—Helping students to visualize content
Examples: Animations that dynamically show relationships between data; Virtual Chemlab to show chemical reactions; Virtual Conductor to show proper view of master conductor
2. **Interactions**—Promoting student/teacher and student/student interactions
Examples: Asynchronous discussion boards in large sections; audience-response to give instant feedback to instructor.
3. **Reflection**—Supporting meaningful student reflection
Examples: Video analysis to compare performance with that of expert or to allow students to have evidence with which to reflect on their performances.
4. **Authenticity and Engagement**—Providing opportunities for involving students in authentic, real-life learning activities
Examples: Simulations to allow students to explore authentic, real-job tasks in safe environment; internet survey tools to allow researchers to complete multiple projects within a semester.
5. **Practice**—Improving the *quality* and *quantity* of students’ practice
Examples: Using Camtasia to record math problems for at-home practice; CAD software allows students to do more construction management projects more quickly.

Recommendations: After reviewing the cases and what the instructors had learned from using these technologies, we identified a few tentative recommendations for effectively using these tools (see Figure 1). These would need to be corroborated through more research.

1. West, R. E. & Graham, C. R. (2005). Five powerful ways technology can enhance teaching and learning in higher education. *Educational Technology*, 45(3): 20-27.

Guidelines for Using Educational Technologies

1. Visualizing Content

Use:

- Simulations to represent abstract or unseen phenomena.
- Simulations to visually depict a phenomena occurring across space or time
- Presentation software, photographs, and video to represent observable, but out-of-class phenomena
- Dynamic models (Flash animations, Java applets, etc) to show the dynamic relationship between principles.
- Allow students to interact with the simulations, pictures, and models.

2. Student & Teacher Interactions

Use technologies to:

- Automate repetitive feedback
- Collect student feedback as a determinant about what you should teach.

With discussion boards:

- Participate in the discussions
- Expect high student participation and critical thinking
- Situate the discussions in class topics that are important and engaging. Avoid meaningless discussions that would be viewed as "busy work."
- Carefully choose questions that will provoke the most discussion

3. Student Reflections

- An effective model may be to use technology to first help students visualize a principle and then to identify examples of the principle
- Use technology to give students something to reflect about, so they do not have to rely on their memory of what they think happened.

4. Authenticity & Engagement

- Use technologies such as video, sound, and simulations to recreate authentic, on-the-job experiences
- Encourage students to use technologies as tools for solving real problems
- Use technologies to bring in authentic materials, data, and sources.
- Allow students to experiment and make mistakes while working with simulations.

5. Student Practice

Use technologies to:

- Automate some tasks so students spend more time doing the work that will teach them the most
- Create opportunities for students to practice skills at home.
- Give students feedback when they need it—during homework and at-home practice.
- Help students remember how they have performed and what they need to do to improve

Figure 1: Some basic guidelines, drawn from case studies of successful teachers, for implementing the five practices for using educational technologies outlined in this paper.

Next Step: Graham has combined the interviews used in this project with those completed for two other projects: 1) a dissertation on blended learning and 2) a campus-wide evaluation of the Blackboard course management system on campus. From this data, he is looking at ways that technology *enables* familiar pedagogical practices, *enhances* familiar pedagogical practices, or *transforms* pedagogical practices. Truly transformative technologies and pedagogies are rare. Most of the cases that we have identified in this presentation are examples of using enhancing technologies. In these examples, the technologies are used as enzymes that “speed up” or “enhance” a process but do not, in fact, change the process noticeably.

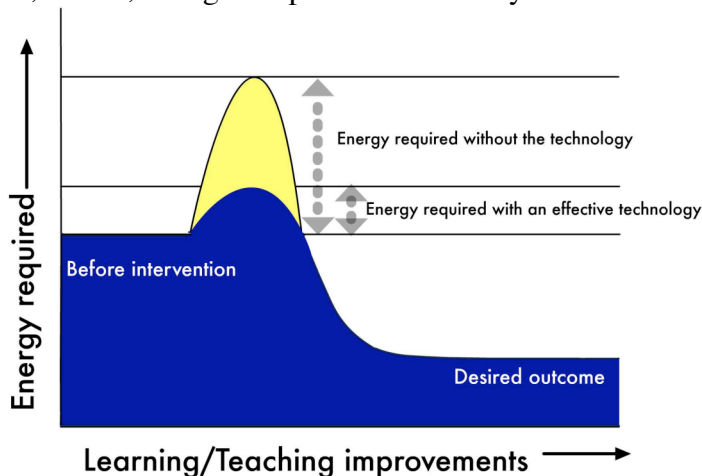


Figure 2: Catalysts reduce the energy required for a biological reaction to occur. In a similar way, technology can act as a catalyst to reduce the energy required to achieving some instructional goals.