Multimedia Learning Environment for Statics

Siegfried M. Holzer
Alumni Distinguished Professor
Civil and Environmental Engineering
Virginia Polytechnic Institute and State University
Blacksburg, VA 24061-0105, USA
holzer@vt.edu

Raul H. Andruet
Staff Development Engineer
Imation Corporation
Oakdale, MN 55128-3414, USA

Overview

> *...for the computer to bring about a revolution in higher education, its introduction must be accompanied by improvements in our understanding of learning and teaching.*
>
> --Nobel Laureate Herbert Simon (Kozma and Johnston, 1991)

Simon's statement has been our guiding theme in the development of a multimedia learning environment in the subject area of statics. It was reinforced by Ehrmann's (1995) suggestion to first select the best methods for teaching and learning and then the technologies that support those methods.

Statics is a branch of mechanics that is concerned with the computation of forces acting on bodies (solids or fluids) in equilibrium. We have developed an active learning environment that includes physical models, interactive multimedia, traditional pencil-and-paper activities, and cooperative learning in the framework of experiential learning (Kolb, 1984). Our laboratory for evaluating and improving this learning environment is a junior-level course taught to students in architecture (ESM3704).

The multimedia program is constructed with Authorware 5 Attain (1999). We are using the program in various ways: (1) to present mini-lectures; (2) to guide student teams in the development of concepts, the solution of problems, and discussions; (3) to provide connections to the students' background and engineering structures; (4) to integrate traditional pencil-and-paper activities; and (5) to preview and review lessons (each student should have a personal copy of the program). The learning environment, the underlying learning strategies, and student feedback are described in the papers by Holzer and Andruet (2000a, b).

Program Development Status

The multimedia program is evolving. We started developing multimedia learning modules for a course in statics. However, we began to integrate topics from mechanics of materials, currently beams, when we realized that students' learning is enhanced if statics becomes part of an integrated course in mechanics. In fact our plan is to go one

step further and present the course in the context of engineering structures. The following outline reflects this plan.

- Introduction
- Structures: History of Structures, Case Studies, Modeling, Analysis
- **Actions**: Forces, Moments, Distributed Loads, Center of Gravity
- **Equilibrium**: Free-Body Diagrams, Equilibrium Equations, Analysis Procedure, Problems
- **Plane Structures**: Modeling, Trusses, Beams, Frames
- Spatial Structures
- Support: Search, Site Map, Glossary, Help

The learning modules listed in Actions, Equilibrium, and Plane Structures (trusses and beams) are close to being completed; they have been used on campus in our course ESM 3704, off campus at various institutions, we made the program available to over 60 faculty who requested it, and even by high school students in a physics class. The modules in Introduction, Structures, Spatial Structures, and Support are in the planning stage. We intend to integrate topics with Case Studies of suitable structures and to include software for simulation studies. In addition, we want to provide audio options and videos on the evolution of structures.

Our goal is to develop an interactive online learning environment that can actively engage students working in cooperative teams or individually at various levels, from high school to college. We will convert the existing modules to on-line versions with Shockwave. Our plan is to build new modules with Dreamweaver and CourseBuilder Extension for Dreamweaver.

References

Authorware 5 Attain, Macromedia Inc. (1999)

Ehrmann, S. C., "Asking the Right Questions: What Does Research Tell Us About Technology and Higher Education," *Change*, March/April (1995)

Holzer, S. M. and R. H. Andruet, "Active Learning in the Classroom," Proceedings, ASEE Southeastern Section Annual Meeting, Roanoke,VA, April 2-4 (2000a)

Holzer, S. M. and R. H. Andruet, "Experiential Learning in Mechanics with Multimedia," *International Journal of Engineering Education*, Volume 16, Number 5 (2000b)

Kolb, D., *Experiential Learning,* Prentice Hall, Englewood Cliffs, NJ (1984)

Kozma, R. B. and J. Johnston, "The Technological Revolution Comes to the Classroom" *Change*, 23(1), 10, January/February (1991)