How can Multimedia help my teaching?

An interview with Dr. John Barrett, Ph. D. (Oregon) M. Cog. Sc. (UNSW)

Dr. Barrett's expertise is in instructional systems design with emphasis on learning and cognition facilitation through the appropriate application of computer and communication technology. He has had a wide involvement in business/industry and government consultancies in Australia. His most recent projects include: a CD-ROM in Tourism and Hospitality Management and another covering best practice in Open Learning across Australia. He has held executive positions in prominent universities in Australia and published more than 120 research and development papers.

He is now working with the Professional Development & Quality Services Unit of the City University of Hong Kong to provide faculty members with support in developing their multimedia instructional projects.

Dr. Barrett visited HKUST on November 3, 1995 to share his experience with more than 30 faculty members and staff in a lunch time seminar.

What is "multimedia" in an educational context?

The term "multi-media" is used to describe combinations of media formats such as using slides and audio tape separately in a lecture. This practice is based on the assumption that the use of multiple sensory channels is more effective than the use of each alone. The "cue summation" principle suggests that a combination of channels offers learners a variety of visual and auditory cues, so each learner is able to select the best cues to meet his or her individual sensory needs. This understanding is confirmed by various research studies and is exercised in the development of any multi-media teaching-learning materials.

Slides, transparencies and audio tapes, sometimes called "low-end systems", still have an important role to play in communication. But the availability of graphical presentation software, like Powerpoint and Persuasion, and hardware like liquid crystal display (LCD) panels have made the production and delivery of the same material or content more efficient and interesting.

"Multimedia" (without a hyphen) is now defined as organized elements of symbols (text—words and numbers), aural (sound effects, music, and speech) and visual (still images, video and animation) integrated in a single presentation system controlled by a computer.

What is the major difference between traditional and contemporary "multimedia" programs?

There are two significant features of modern multimedia instructional material—it is highly integrated and interactive. It is interactive in the sense that users (students) can have access to information in a non-linear way. Due to this interactivity, they form their questions, explore, discover and create their individual answers. In other words, they learn in an environment that stresses a constructivist approach to learning, not a passive one. It can integrate learning activities such as simulations, case studies, quizzes, working reports, creating notes and solving complex problems.

I have to emphasize that multimedia can be powerful, but it is the design of instruction and the resulting learning activities that really establish its educational validity. It is just one of the many available tools for teaching.

Why we need multimedia in our teaching? In what ways can it help in teaching?

It is not a question of why or why not. It is a matter of choice of tools to be used to enhance the teaching-learning process—with students' learning being the focus of all our teaching effort. As was said previously, the use of computers in education can help students learn more effectively in many ways. For example, simulations in different disciplines have been used for years to help students to develop their analyzing and problem-solving skills in handling real-life problems and to experiment high risk situations. Multimedia courseware allows students high quality instruction independent of time and place. But it can also be integrated with communications software to provide a co-operative and social learning environment.

We are now facing a group of students who were brought up with computers as their toys. As one of the "consumers" of our educational system, their demands on the use of computers and technology in teaching is becoming much stronger than in the past. Similarly, employers of our graduates expect high levels of computer literacy.

In a broader prospective, use of technology in teaching will soon have a decisive influence on institutional competitiveness—in a global sense. The use of Internet in accessing information worldwide and the use of Email in tutoring will change the nature of universities from archives of learning resources, assessable to a confined group of learners to information providers in the international marketplace. Learners will have tremendous choice of courses and information.

Is there any proof that students learn better with multimedia?

Research findings show that the use of multimedia-based instructional materials helps students increase retention and decreases learning time if the material is well designed. It also provides individualized instruction and assists students in information assimilation and processing.

However, it is not meaningful to assess the impact of isolated multimedia-based instructional materials on overall learning outcomes since learning is a very complicated process with few predictable results. As Stephen C. Ehrmann pointed out, post secondary learning is not usually so well-structured, uniform or stable that one can compare an innovation (e.g. a multimedia-based presentation) against "traditional" processes (e.g. a pure lecture) without specifying in explicit detail of just what those processes are. And by specifying in detail what "traditional" means (what materials, what methods, what motives), you limit your study to very small and temporary universe.

What are the issues that a teacher has to think through before adopting the multimedia approach?

Multimedia is not a panacea to all our teaching needs or problems. For example, it cannot substitute for the diagnosis of errors or learning difficulties by a good teacher/tutor. (Though there are a few very advanced Intelligent Tutoring systems which are outstanding in a restricted domain but took incredible resources to develop.) The content must be correct/accurate and the instructional design right before a good "learning tool" can exist. How one makes use of this tool is just as important as the tool itself.

The key question that a teacher should ask before any attempt to develop or produce teaching-learning material in multimedia mode is: In what ways can this approach/product help my students learn more effectively and in what ways it can help me teach more efficiently?

My suggestion is, take a systems approach to analyze what you are doing right now (teaching) and ask yourself some questions, such as:

- What do I want to accomplish in teaching this subject?
  What do I want my students to learn at the end of this course?
- How much content will I cover in the course in relation to my aims and how can I "represent" this content?
- How am I going to organize the teaching content and make it meaningful to my students?
- Who are my students individually? As a whole, do they have any special cultural/language attributes? How do they learn?
- How do I usually teach? In what ways would I like to improve or teach in a different way?
- What instructional strategies can help my students learn best?
- What resources are available to support the development and production of a particular teaching material in multimedia form?
- How can I monitor the new procedures in ways which will allow modifications or corrections in the learning environment?

In terms of production, a multimedia project will generally go through four stages in a cycle—design, development, delivery and evaluation. The cycle will keep on revolving for improvement until the "final" product is introduced. The package will require maintenance and up-dating but this is much more easily achieved with materials that are in an electronic form.

And don't neglect the communications prospective. Computers and communications can be used appropriately to provide a link between tutors and students, fellow students and all participants as well as course administrators.

Are there any multimedia teaching programs available that I can use in my teaching?

There are quite a few multimedia-based instructional materials that form parts of a subject. For example, simulations in different disciplines, Expert System which simulates how an expert solves a problem, Algebra Tutoring System, etc. Their integration into the teaching process has to be carefully monitored. (Please refer to the end of this paper for more examples.) Do consult your librarian and local distributors for further information.

There are few multimedia programs which are the "complete learning package" by themselves. They take a lot of resources and a long period of time to develop.

If a teacher wants to develop his/her own multimedia-based instructional materials, where should one start?

Projects of this kind can be started small and keep growing. For example, a lecturer can first use PowerPoint (a graphic software) to convert a set of slides into electronic form so that updating becomes much easier. Later some audio can be added to the slides to create an automatic slide show. Further, with the help of an authoring software transparencies can be integrated with video and sound clips and the slides into one single synchronized presentation program. This presentation could then be turned into an individual learning package. However, a great deal of thought, planning and commitment is required to produce a successful package.

Few teachers are skilled in both content design and materials development, like instructional design, video production, authoring, etc. Technical support to teachers is a must. A team approach with specialist support is the model we are implementing at City University.

Can you elaborate on ways to provide technical support to teachers in the design and development of multimedia-based instructional materials or programs?

There are three common ways to do so:

1. "Give the teachers the production tools and let them do it themselves"

Workshops may be organized to help teachers make use of the multimedia. This approach gives the teacher the greatest control over the project but is also frustrating under time constraints, resource usage and demands to know all production techniques.

2. "Let's set up a central design and development unit with experts so that teachers can drop their work request here and pick up the desired products later"

Experience tells that few teachers would drop in their requests in this way because few understand the educational and technical design issues and solutions. And centralized units almost always develop "a mind of their own" and lose sight of client needs. Besides, Interactive Multimedia by its very nature demands a team approach.

3. "Help teachers to do what they can do best"—a networked team approach to work with teachers to design and develop multimedia-based instructional material with the involvement of the teacher all way through.

There are "consultants" in the design and development unit who help teachers conceptualize, plan, and develop multimedia-based instructional materials. There are technical experts who help to produce the visuals and so on, but the teachers know exactly what is being produced. They are in control of their project's outcomes but the production is orchestrated by specialists who have "know-how" tools and time to dedicate their energies to the development tasks. Usually there will be a moderate start and the projects grow progressively.

The third approach is the one that I am advocating at City University.

What benefits can a teacher get from participating in the design and development of a multimedia project?

1. More effective instruction so the teacher can have more time to concentrate on teaching, or research, or both.
2. Materials that are easy to update.
3. Better response and performance from students.
4. Chances for research (and publication) especially in teaching within their discipline. The delivery of the materials and evaluation of its effectiveness is a research project and provides an opportunity for publishing in discipline-related journals.

The document of the effort to develop a multimedia-based instructional material will form a good chapter in one's teaching portfolio for career advancement purposes.

And last but not the least, the teacher has gone through an intensive self-directed development program which benefits both the students and the teacher. Where else can a teacher learn better, with support, about the learning process and instructional design than by a self-initiated project like this?

There are quite a few "edutainment" multimedia package in the market. How to adopt some of them in teaching?

I suggest to have a thorough preview of the materials, put yourself in the learners' position, and ask some essential questions afterwards:

- What does it teach me? What are the messages? Are the contents accurate? Do they tell me something new that I am unaware of?
- What do I learn from this other than entertainment?
- Who is this material designed for?

There are also some critical instructional questions. For example:

- How is the content organized?
- What kind of knowledge does it convey? (Bloom classified different types of teaching-learning objectives in the cognitive domain, from knowing some basic concepts, understanding of facts and principles, application of the concepts or rules, evaluating the relevance of data to judging their adequacy, consistency and value.)
- What intellectual demands do the contents/activities elicit?

Integrating of any form of teaching materials in one's teaching asks for very detailed planning with student learning at the focus. Knowledge of the teaching-learning process is the prerequisite here.

Some examples of multimedia applications

Simulations

Simulations using videodiscs or simply computers, have been used for many years in different disciplines. They allow teachers and students to study concepts that otherwise would be impossible to explore, to perform "experiments" that would be expensive or dangerous in a laboratory, and to provide remedial activities and practice as necessary.

Examples are numerous. There are multimedia programs to help science and mathematics students to explore through microscopic worlds or immense solar systems; to enable engineering students to calculate the possible vibration of a non-existent bridge at different loadings; to teach law students to interview witnesses; to teach dental students the correct angular placement of teeth; to help business students to diagnose a company's marketing problems and recommend solutions; to help humanities students to study a live performance of Shakespearean play, isolate and analyze its components, compare film segments of corresponding scenes by different directors and stage their own interpretations.

Hypercase of the Massachusetts Institute of Technology

This multimedia package is designed to help business students interact with the case under study. A videodisc containing edited interviews and demonstrations helps learners explore methods for industrial research and analysis. These video segments also allow students to review verbal and nonverbal cues that are essential to the decision-making process.

The Comprehensive Unified Physics Learning Environment (CUPLE) Version 1.0, 1995

The CUPLE system is a multitasking, windowing, graphic environment for learning physics that combines hypertext materials, computational physics tools, video from videodisc, videotape or other sources, and computer data acquisition. It is designed to be used in lectures, laboratories, recitation, homework, workshops or independent study situations.

As mentioned in its Developer's Manual, it is an environment in which innovative (teaching-learning) approaches can be developed and tested. The rationale behind it is straightforward—"The rapid growth of technology changes both the way physics is done and the way it can be presented to the student. The fact that it changes the way physics is done means that we have to rethink the content of the physics curriculum and what it is we want our students to learn. The fact that it changes the way we can present the material means that we have to reconsider the environment and the materials with which our students learn physics."

The Tourism and Hospitality Management Package The Queensland Open Learning Project, Managed by the University of Southern University Queensland Distance Education Centre

This multimedia CD-ROM package has exemplified a new approach to the development of similar packages—using an electronic document processing approach to facilitate data storage and manipulation.

At HKUST, there are several faculty members who are developing their own multimedia-based teaching tools, e.g. the Active Physics Learning Environment (APLE) project in the Department of Physics; the Multimedia project in the Department of Civil Engineering; the Virtual Office project in the Department of Information and Systems Management. (Please refer to Genesis (Volume 6 No. 13, November 15, 1995) p. 2 for details.)

References

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