Using Animation on the Web for Teaching Plant Biology

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Abstract: This paper describes the design, development, and delivery processes of multimedia modules such as Macromedia Flash®, Shockwave movies®, and Quicktime movies®. These modules were employed to teach a undergraduate plant biology class at a large southwest university. Each medium has different strengths and weaknesses and their proper use resulted from the collaboration among the content experts, instructional designers, and multimedia developers.

Equipped with Web technologies, instructional designers have abundant resources to deliver courses using multimedia and rich interactivity. However, design is only one of several crucial factors of a successful web-based course. No matter how rich the media features are, obstacles during implementation hinder students from effective learning. For example, faculty without experience in multimedia development and distance education may under-estimate the required cost and resources, which may result in a delay of delivery and frustration on the part of the instructor and students. Digital movies are said to be a useful illustration tool, however, lack of appropriate plug-ins and bandwidth may make the media unusable instructionally. In light of these potential obstacles, this paper discusses how a major university designed, developed and delivered a feature-rich web-based plant biology course . It was found that in this case the actual design and delivery processes were more problematic than development of the instructional modules. Solutions derived from our experience are suggested. In order to deliver the course effectively, use of multimedia animation were considered because several concepts in biology are process-based; it is more instructionally beneficial to illustrate those concepts in animation than plain text. The implementation of this multimedia web-based course was divided into three stages: Design, Development, and Delivery.

Design

PLB108 was a collaborative project between the Biology department and the Instruction Support Group. Faculty and graduate assistants in the Plant Biology department served as the content experts. Staff in Instruction Support, which is housed within the Information Technology Department, served as instructional designers and multimedia developers (design team). The design team advised and assisted with course design, interface design, and storyboarding. The design team identified three different medias for serving different purposes, namely, MacroMedia Flash (MacroMedia, 2000a), Director shockwave (MacroMedia, 2000b), and QuickTime (Apple, Inc., 2000). Each has capabilities as well as liabilities as described below.

MacroMedia Flash uses vector-based graphics and therefore making its file size much smaller. However, vector-based graphs are best-suited for drawing-based images rather than photo-realistic images. Moreover, it lacks the interactive features and programming capabilities of MacroMedia Director. Shockwave is a multimedia authoring system made by Macromedia Director and complicated modules such as highly interactive tutorials are better created in Director. However, since the graphics in Director are pixel-based and thus the final product, may be bandwidth-consuming. The strength of QuickTime is its ability to show realistic movies within a low bandwidth because certain third-party software utilities such as Media Cleaner Pro are able to compress QuickTime files without losing viewable quality. One of the drawbacks is that QuickTime does not have many interactive features. Among the three chosen media, QuickTime is the most bandwidth-intensive.

The faculty worked closely with the Instructional designers to take ideas for concepts and convert them into a manner that best utilizes the multimedia delivery system. The following combinations of media and content are considered proper matches:

In the course, Flash is primarily used for modularized presentations. When a complex process is presented, a continuous and linear animation such as QuickTime may cause confusion among learners. An interactive step-animation was designed with the logical breakdown of the process. For example, the *Meiosis Process* was broken down into three steps. In each step, the animation is co-presented with text. The learner has the freedom to replay a particular step of animation. This approach is also useful to illustrate complex structures. In the Flash module displaying a flower structure, different components are shown in different steps, but the transition between steps is a translucent overlay so that students can see how different parts of a flower are related to one another other.

Shockwave is used for tutorials that require user interaction. For example, in the illustration of natural selection, users are asked to drag a dark moth and a light moth to a light-colored tree. Later the same moths are dragged to a dark tree darkened by pollution. It is pointed out in the instruction that before the pollution, the light moth is more likely to survive because of its protective color in relation to the tree. After the pollution, the survival chances tip toward the dark moth. The objective of this exercise is to let learners see how environment affects natural selection. Although this concept can be illustrated by text, the camouflaging function of moth's color is more dramatic to learners when they actively move the moths from one background to another.

QuickTime is a proper medium for realistic movies. For example, many biology students may not have a chance to use an electronic microscope to observe objects at the molecular level such as how a new life is formed through the fertilization of an egg by a sperm. This web-based course includes QuickTime movies, which were converted from footage taken from microscopes. Another use of digital video is the re-creation of historical events. Reading text about history may be dry, however, dramatization of history by actors and actresses gain students' attention. In this class, Mendel and Darwin, prominent figures in biology, come alive in digital video interview.

Development

Instructional designers worked with multimedia developers to convert the storyboards into multimedia and upload the course to the web. With each release, the faculty proof-read the media and provided feedback. To simulate a realistic learning environment for beta-testing, testers accessed the web content through a dial-up modem and viewed them in a 15-inch monitor. It was found that download time of QuickTime movies was excessive. To counteract this problem, QuickTime movies were burned into a compact disc and offered to students as an alternative. To increase the user-friendliness of the CD, an interface, designed with MacroMedia Director, was inserted so that users could easily navigate between movies. Taking bandwidth into consideration, the development team decided to convert QuickTime movies to QuickTime streaming and Real streaming movies in the next release. The difference between a digital movie and a digital streaming movie is that the latter can play almost immediately while more signals are being "streamed" to the destination. The copyright issue was a major concern during the development process. Besides using royalty-free images, the development team created many drawings and diagrams. Approximately half of the development time was spent in creating original artwork for the course.

Delivery

The course is delivered through Blackboard's CourseInfo®, which has built-in features for Web-based courses such as login, quizzes, grade book, chat room, bulletin board, user access tracking, and many others. Students were required to log in, and their movement within the course website can be tracked. Additionally, student scores on quizzes are recorded. Despite the hardware and software requirements, which were specified prior to the course, several students were not able to fully access the course materials due to the absence of a proper Web browser and plug-ins. This was anticipated and a technical support team stood by to provide assistance in upgrading the browser and installing plug-ins. The technical support service was accessible by both email and telephone.

Summary

Initially, the design process and development process were labor-intensive. It is important to structure the materials during the design process so that later modifications are minimal for future courses. Moreover, when the course is well-structured with rich content and media, based on the input from experienced faculty, a graduate teaching assistant, for example, is able to deliver the course seamlessly. As a result, experienced faculty can be released from teaching introductory classes and concentrate on research and teaching of upper division courses.

References

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