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ABSTRACT

"Straight" lecturing as the only method for information delivery was at one time an efficient means of college teaching. Increased enrollment in the biological sciences, the diversity of preparedness of the students, and the variety of learning preferences of the students require new ways of disseminating information and assessing classroom learning. Multimedia provides an excellent tool to integrate various teaching methodologies, address differences in learning preferences, and deliver factual and conceptual information with speed and proficiency. At the introductory level where large class sizes are the norm, multimedia helps to address a number of problems: class size, learning differences, early class times, sleep deprivation, disparity in student's scientific skill levels and the attention span of students. In small upper level classes, multimedia, computer simulations, and Internet assignments help to develop a partnership between the student and the material, the student and their peers, and the student and the professor. This paper details some of the multimedia techniques that address the difficulties in teaching both large introductory and the small advanced level classes in the life sciences. (SWC)

Multimedia: Bringing the Sciences to Life - Experiences with Multimedia in the Life Sciences

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Introduction

'Straight' lecturing as the only method for information delivery was at one time an efficient means of college teaching. Increased enrollment in the biological sciences, the diversity of preparedness of the students, and the variety of learning preferences of the students require new ways of disseminating information and assessing classroom learning. With the availability of technology and the awareness of learning styles and preferences teachers can, and need to, respond to the various learning modes in creative ways. Multimedia has provided me with an excellent tool to integrate various teaching methodologies, address differences in learning preferences, and deliver factual and conceptual information with speed and proficiency.

In the life sciences the increasing availability of multimedia material is a double-edged sword. Exceptionally well-produced videos and animations can overwhelmingly enhance a lecture; however, evaluating the vast amount of information that is now available is labor intensive. Despite the wide assortment of materials, many titles are inappropriate for college level courses. Nonetheless, incorporating concise illustrations or animations can aid in the conceptualization of a difficult theory and make the effort rewarding for both the teacher and the student.

At the introductory level where large class sizes are the norm, multimedia helps to addresses a number of problems: the class size, learning differences, 8:00 am class periods, sleep deprivation, disparity in student's scientific skill levels and the reported two to three minute attention span of today's college students. Thus, with this diversity comes the need to remediate those who have little or limited scientific background and at the same time challenge the advanced student. In the small upper level classes, multimedia, computer simulations and Internet assignments aid to develop a partnership between the student and the material, the student and their peers, and the student and the professor. Detailed here are some of the multimedia techniques that address the difficulties in teaching both the large introductory and the small advanced level classes in the life sciences.

Multimedia in the Large Classroom.

When I first began teaching large introductory General Biology class I mimicked many 'who came before me' and used the overhead projector and the transparencies that accompanied the text. However, the standard overhead projector is not designed for a large lecture room screen, and many students have trouble seeing the transparency's details from the back of the classroom. Needless to say, it is virtually impossible to engage the students in active participation when they are unable to clearly see the material presented. Knowing that I could do more to increase the students' learning potential and at the same time develop a more organized and manageable way to store and update my lectures, I sought the advice of the Instructional Resources department. The director, Mr. Steve Rutter, introduced me to the computer-based slide show of the Aldus Persuasion[a] presentation software and within a few days I was off and running. Converting lectures to a computer-based slide show format allowed for the full use of the screen in the large lecture room, and the written text and images were much sharper. For faculty who are having success with the straight lecture style, adapting to a computer slide show presentation by using either Power Point[a] or Aldus Persuasion[a] is extremely simple and relatively labor free. If the transparencies or lecture notes are written with a word processor program then they can be easily pasted into the presentation programs. The computer slide show can be used in conjunction with the overhead projector and accompanying transparencies. By all means, it is not necessary or time efficient to scan transparencies directly into the computer slide show. An alternative to transparencies, but a little more labor intensive is to use text figures supplied by the publisher on an accompanying CD-ROM. However, be sure that the figures on the CD-ROM can be selected and cut from the disk into *your* slide show program.

Incredible advances in the life sciences from year to year, leave many of us barely enough time to keep up with the literature, let alone time to 'design' multimedia presentations for the lecture. Elizabethtown College is fortunate enough to have administrative support coupled with a superb technological staff that has committed to the installation of Smart Classrooms. What is a smart classroom by Elizabethtown College standards? The Smart Classroom combines many forms of instructional media into one system that is remotely controlled via a single operations panel. The key component of the system is a high resolution data/video projection system. The instructor can operate the system with minimal preparation and equipment setup. An AMX customized, programmable microprocessor-based remote control panel can adjust the lights, operate the curtains and projection screen, and control the volume on the sound system, often with the touch of a single button. In addition, the various pieces of equipment such as the S-VHS VCR, Laser Video Disc Player, Telecine, Visualizer, and Video Projector can be controlled. All steps of the presentation are combined into one or two button selections. The installed computer system also has the ability to control the equipment through software as well as display text, graphics, animation, spreadsheets, etc. In addition to the prerecorded forms of media, it is important to note that the smart classroom also has the capability to interact with the outside world. The Video Projector can display forty cable TV channels, in-house college educational programming, and live satellite teleconferences from around the world. The telephone system provides access to guest speakers through interactive audio conferencing.

In the past we had to assemble a multimedia system by removing a computer from someone's desk, a VCR from a classroom, and a laser disc player from the library, and patch the devices into a low quality LCD overhead projection display. The systems were unwieldy and difficult to operate. One main advantage to the dedicated smart classrooms is the fact that system is fully operational,

contained in one lockable podium, and requires no setup. The instructor simply turns a key to power up the devices, boots the computer, and is ready to go. With installation of the campus computer network, and the ability to share files between computers, it is possible for the instructor to have complete access to their computer files, essentially bringing the office computer to the classroom.

With this type of system it is possible to use the laser video disk that accompanies my introductory text. The Laser Video Disc Player is a playback only non-linear video format. It can play continuous video programming, or access individual video clips, animations, or still pictures. Video frames that are used to accompany the lecture topic are either accessed through remote control address entries, or through computer control. However, when lecture preparation time is limited I can simply integrate figures or graphics into the lecture by using the visualizer. The visualizer is also commonly referred to as a document camera. A high resolution document camera can display images placed on the stand through color video output. Using downlights, three dimensional objects, papers, photographs, books, maps, etc. are projected over the high resolution data/video projector. Transparencies can be displayed by activating the baselight. Thus, there is no cumbersome transition between the computer slide show and an overhead projector. The high resolution data/video projector enables the integration of a variety of multimedia sources and is capable of displaying a large screen image from the input. A routing switcher, line doubler, and computer interface box are responsible for providing proper signal rates and formats to the R-G-B inputs on the projector. Control of the projector and switcher is maintained by the AMX system.

Multimedia and Active Learning:

Although the sciences rely heavily on information delivery my desire is always to incorporate active learning strategies into the lectures and to address the different learning preferences of my students. In a large lecture setting it is often difficult to assess if all class members are comprehending the biological concepts. I observed a quick, easy assessment at the National Conference on Collaborative Learning in June 1994. A Harvard Physics professor, uses a Think-Pair-Share technique for large class sizes to 'test' whether his students had grasped the concept that was just presented. Think-Pair-Share is designed to assess the student as follows: 1) each student individually reads the multiple choice question on the slide; 2) they choose the 'correct' answer individually, and then; 3) pair with the person next to them to quickly discuss the answer. The lecturer can then immediately poll the class by a show of hands to see who is 'on-track'. By using multimedia these Think-Pair-Share questions can be easily added after each conceptual segment of the lecture. This active learning strategy coupled with the multimedia presentation makes the information delivery more efficient, the class more attentive, and the conceptual learning more successful.

Multimedia Addresses Learning Preferences:

As educators we are facing a student body that may not learn in the same way that past generations of students did. Moreover, in the introductory science class we are challenged with the classroom mosaic of students whose science exposure ranges from abominable to phenomenal. Often students do not even know how to study, let alone know what their preferred mode of learning is. Multimedia is the only way I have found that enables me to educate and deal with this freshman melting pot. Within each session the slides can be designed to accommodate the textual learner (straight text on the Power Point slide), the visual learner (integration of animated sequences or the use of the visualizer for mini classroom experiments), and the auditory learner (Think-Pair-Share activities and

video). The laboratory experiments meet the needs of the kinesthetic and tactile learner.

Multimedia can actually help students determine their learning preference(s). Introductory science courses are many times referred to as the student 'weeder' courses. Frequently, the student who does not succeed at this level may not actually be less intelligent than his or her peers but rather the failure results from not being challenged in high school. These students were never 'forced' to developed efficient study strategies. For students to study efficiently they must recognize that they have a distinct learning preference. Many science students do not discover that they are inefficient at extracting and comprehending the conceptual material from the text until they have failed the first or second exam. At this point the student is directed to the campus Learning Center, if your college is fortunate enough to have one, to determine if his scientific career is salvageable. To try and combat this recurring nightmare, I instruct my students in the first weeks of class to be attentive to not only WHAT information is presented but HOW the information is presented. They must determine quickly if the concepts were more easily understood because of the ease of the material or manner in which they were presented.

In addition to aiding the students in determining their learning preference, the multimedia presentation can be used to help the students study and improve their note taking skills. Science textbooks do not always present the information in ways needed for all students to comprehend the conceptual connections. Some students learn efficiently from the 'outline' format of the scientific textbooks. However, other students need to rearrange the information to reveal how the concepts are connected. By varying the formats used in the multimedia presentation of the textual material, students can 'experience' multiple styles of note taking. Some students discover that they need to 're-write' the text in a clustering or mapping fashion to develop and understand the conceptual connections. These types of presentations are fairly easy to assemble and the pay-off is often 'saving' some students from that disastrous first term.

Multimedia in the Advanced Level Classes.

All of the teaching strategies using multimedia mentioned thus far also apply to the small classroom or the advanced level science classes. However at the upper level, multimedia presentations can be expanded upon by incorporating computer programs and the Internet. When choosing computer simulation programs or, designing Internet activities three points must be considered:

A) the scientific merit of the program
B) the ability of the program to transition smoothly into your lecture or be designed as an out-of-class activity and
C) the scientific background of the student.

A) Choosing a worthwhile program is not difficult but it is time consuming. Conserve your efforts and search for programs and video clips that accompany concepts that you believe are difficult for the student to comprehend. In searching for these things you will encounter other material that you can save and use in your lectures.

B) Many computer programs (software) are now available but not all are appropriate as visuals for the lecture period. The segments may be too long or they may not be 'compatible' with the multimedia lecture presentation. Computer simulations such as HyperCell[a] are a remarkable benefit to many students. However, I use this program as an out-of-class activity because it monopolizes

the computer and you can not transition back and forth between Hypercell[a] and Power Point[a]. In purchasing a site license for this program I can design group or individual activities that require the students to utilize the information on the selected software. Of course, this involves more work for the instructor since you must assess that the students did use the program and accomplish what you wanted them to learn from the 'activity'. Because I seek to make these assignments enjoyable and informative, I often create scenarios where the students must use the program to solve some clinically relevant problem. For instance, I have given assignments where individuals or groups must use the software to determine why a patient is dying from specific drug interaction. Or, to make it more exciting and competitive, scenarios can become more complex. For example, groups must race to save the world from an invading alien species that has poisoned the water supply with a toxin that blocks the adenylate cyclase pathway. Groups must submit their antidote and its mechanism of action for credit and assessment. In designing conceptual scenarios for the computer programs (versus a list of figures and animations for the students to simply view) students must use the program to: 1) understand the biological mechanism; 2) determine what is wrong in the scenario and; 3) fix the problem. If you have a very large class you can have the student groups exchange papers for a triage grading. In this way students inspect other possible answers and are forced to scrutinize a different mechanism for potential flaws in logic. This type of computer supplement to the classroom lecture allows for more material coverage and actually permits more time to delve deeper into concepts than would be possible in the finite class period.

C) The most difficult part of choosing a visual aid or a computer software program as a supplement for the lecture is assessing the actual benefit to the students. As in the activity outlined above, assessment is done after-the-fact to determine if the student learned what the activity was designed to accomplish. However, for the student who is struggling with basic mechanisms, or if his/her conceptualization of science is weak, the visual aid can cause more confusion than clarification. The frustration often results because a specific student has been a memorizer of information and an effective regurgitator of facts, but now he or she is having trouble creating conceptual connections. However, although the student becomes frustrated it is possible for the instructor to identify this individual and address their study skills.

A second success that I have had with computer usage in the upper level classes is the integration of the Internet to promote independence in student learning. This past semester yielded one of the highest student learning achievements I have had to date. In conjunction with a Speaker Committee at the college I brought Richard Preston, author of The Hot Zone, to campus. This non-fiction book details the history of the Ebola virus and the hair-raising efforts of the US Army and Center for Disease Control (CDC) officials to contain a possible Ebola outbreak in the United States. The book was assigned as reading material for the class, and students were instructed to use the Internet to obtain general information about single stranded RNA viruses and specific information regarding Ebola. Much to my delight, students began a crusade for information, downloading volumes of material that were posted on a common bulletin board. The students were as excited to obtain the information as they were to learn about the scientific subject. To aid in assessing if the students were learning the specifics of single stranded RNA viruses, and viruses in general, I dedicated one laboratory period to show a video on the latest Ebola epidemic followed by a discussion of the movie and the Internet information. The 'discussion' was designed to test not what information they had gathered but how much they understood the reports. This entire exercise was extremely successful on both a personal note and as witnessed by the class exam scores. [My wish would have been to make the bulletin board an electronic one, but this I will save for next year.]

How to get started.

If you would like to use multimedia in your classroom it is important to start slowly - very slowly. Begin by simply transferring your lecture material into a slide show presentation. You can then add visuals in the form of transparencies projected through the visualizer/laser disk or cut into the presentation from a CD-ROM. If you have the time, you can begin to scan the Internet for added information. Internet information can be found in the form of electron micrographs (www.blocklabs.wisc.edu/Welcome.html) or live motion video of cellular events (www.cellsalive.com). I have found that for a video sequence to be effective it needs to illustrate the concept you dictate in a short time frame (2-5 minutes). Many commercially available videos move too slowly to be effective and can actually detract from the lecture. Thus, I have had more success with video sequences downloaded from the Internet.

As we approach the 21st century it is more imperative than ever that all students, not only science majors, grasp the basic concepts and technical advances in the life sciences. In this next century it will be necessary that we as teachers take advantage of the technological and human resources available on our campuses, be cognizant of varying learning preferences, and adapt the technology to these preferences. Multimedia presentation has allowed me to reach out to all students in ways I would never have accomplished without it. Technology and multimedia will never replace teachers. However, with the changing learning and lifestyles of today's students, teachers who use technology and multimedia may replace teachers who don't.

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