
IMPLEMENTATION OF MULTIMEDIA INSTRUCTION IN BIOLOGY AND CHEMISTRY COURSES: STUDENT REACTIONS

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“The new stress on multimedia presentations and on integrating the Internet into instruction is a challenge to both experienced and novice teachers. Those who have been in the classroom for years must change their teaching styles radically to accommodate these new sources of information. And new teachers have to worry not only about mastering content and classroom teaching techniques, but also about being comfortable with several forms of technology in the teaching setting.” Flannery (1998) - from her review of two general biology textbooks.

INTRODUCTION

Incorporating multimedia instructional materials into college science courses is a daunting task which has become almost a requirement for those of us who teach such courses, as indicated by the quote above from Flannery. While several different options exist for how such implementation can occur, all approaches face three obstacles that need to be overcome for implementation to be considered successful: 1) funding constraints, 2) preparation-time constraints, and 3) acceptance by students. After a brief mention of how obstacles 1 and 2 were overcome, we focus in this paper on our findings concerning obstacle 3: acceptance by students.

Overcoming Obstacle 1: We were fortunate in that Mount Marty College (MMC) received a Title III grant from the U.S. Department of Education, one aspect of which was to fund a Computer-Aided Instruction (CAI) Lab and to purchase software, so we were able to overcome obstacle 1 to a certain extent. Our CAI Lab has two rooms, with 10 IBM PC clones in one room and 10 PowerMacs in the other. In addition we were able to purchase many CD-ROMs and other software packages in multiple copies so that student access was not a real problem.

However, once past the problem of funding and obtaining the hardware and software, we still faced obstacles 2 and 3.

Overcoming Obstacle 2: Putting in the “prep-time” on the multimedia materials is an unavoidable, but necessary, requirement for successful implementation. We

all know that the Web is unregulated, so while it may be attractive to merely set students loose on the Web, this approach can be very time-consuming and frustrating for students (especially for “Web-naive” students) if they begin by accessing sites with dubious information, so instructors must provide guidance at least to direct the students to reliable sites to start with. Or if course materials are to be distributed through an instructor’s homepage with “reliable” links built in, there is the prep-time required to compose such a homepage, and to keep it current. And while pre-packaged materials may seem to circumvent this problem, they still need to be previewed by the instructor to evaluate accuracy, extent and depth of coverage of the ideas, and the appropriateness of the level of presentation and of the interactive quizzes that may be included. For example, we have previewed CDs that covered so much material in such depth that they were inappropriate for the undergraduate level, at least for freshman level courses at MMC. We have found others that presented small inaccuracies that could potentially cause conceptual difficulties if unnoticed and uncorrected by the instructor.

Unfortunately, no matter which approach is taken, preview and preparation needs to be done, but it is a task that must often be added on top of already existing tasks (e.g., lab prep, course prep, textbook review, committee and departmental meetings, etc.). While we feel that this is a real problem that needs further discussion, we will delve into a more extensive discussion of this problem in another forum. However, for our purposes here, let us say that we were able to overcome obstacle 2 (in addition to overcoming obstacle 1) so that we were able to present our courses in a way that incorporated much use of multimedia materials starting in the fall semester of 1997.

Overcoming Obstacle 3 (Acceptance by Students): In this paper we wish to focus on student reactions to multimedia instruction, for that, we feel, is at the heart of the matter: the investment of money and time required to overcome obstacles 1 and 2 will be for naught if the students don’t use and benefit from the multimedia materials. And while there are a number of papers in the literature advocating the use of multimedia in the classroom (Blystone 1993, Darensbourg 1996, Dessy 1997, Graziadei and McCombs 1995, Greenhalgh 1997, Huang 1991, Jones and Smith 1992, Jones and Berger 1995, Kozma 1994, Marsa 1995, Moore and Miller 1996, Smith and Stovall 1996, Waldow 1997, Watkins 1992), and a number of “how to” papers describing methods of implementing multimedia in the classroom (Collins 1995, Hall 1996, Hayward 1996, Mounts 1996, Radice 1997), only a few references attempted to gauge student reaction to the use of multimedia in the classroom (Amend and Furstenu 1992, Buttles 1992, Fitfield and Peifer 1994, Treadway 1996).

Here we report on student reactions (acceptance and use) to the incorporation of multimedia materials in freshman-level biology and chemistry courses based on the responses and comments given by students to open-ended questionnaires of our devising. Because of the different approaches taken in our courses we are able to report on the difference in acceptance and use of CD-ROMs -vs- acceptance and use of the Internet; and as a result of the differing

composition of students in our courses we are able to report on the acceptance and use of multimedia by science majors -vs- non-science majors. Finally, based on these results, we draw some tentative conclusions on the efficacy of incorporating multimedia into the classroom.

METHODS

Two questionnaires were administered to students at the end of fall semester 1997.

Questionnaire #1 was administered to both of Sorenson's freshman-level biology courses: Biology 103: Principles of Biology, a course intended for science and pre-professional majors, and Biology 106: Introduction to the Life Sciences, a course intended for non-science majors and taken mostly by students to fulfill a General Education requirement.

Questionnaire #2 was administered to Guetzloff's freshman-level Chemistry course: Chem 101, a course intended for nursing majors and other health science majors, and also to Guetzloff's sophomore-level Physics course, a course required of all science majors.

RESULTS AND DISCUSSION

Sorenson's classes emphasized the use of pre-packaged CD-ROMs to provide information for review and to provide interactive quizzes, while Guetzloff's courses emphasized the use of the Internet to provide similar features. Notice that among the science majors and nursing majors (Bio 103, Chem 102, Physics) acceptance and use is well over 50% (Tables I, III, and IV), and the reasons most commonly given by students for use deal primarily with trying to enhance comprehension of complex topics (Table I).

Sorenson's two classes allow a comparison of the acceptance and use of CD-ROMs between science majors and non-science majors. Notice that half of the students in the science-majors course (Bio 103) reported using the CD-ROMs "a lot", while only one student in the non-science majors course (Bio 106) reported using the CD-ROMs "a lot" (Tables I and II). We believe this is indicative of the level of commitment and motivation of the students: science majors used the CAI materials to enhance their understanding, non-science majors were mostly unwilling to make the time-commitment, and this is evidenced in their written comments. However, other possible implications that can be derived from their responses, and especially from their written comments, is that the non-science majors are already time-limited (e.g., "I work 40 hours a week and it's hard to find time to get into the lab to view the CD-ROMs") or are easily frustrated by computer glitches (e.g., "I tried it a couple of times and couldn't really get it to work. Just frustrated me.").

According to Guetzloff's results (Tables III and IV) students feel that presentations employing a digital format do improve the lecture compared to a more traditional lecture format (Tables III and IV, questions 3 and 4). The students

seem not to like the listserv (class-list e-mail, now more commonly referred to as Virtual Office Hours) as much (Table III, question 5, 6, 7, 8). This was mainly due to student apprehension or unwillingness to learn new computer applications. There were numerous informal comments from students indicating that they were afraid of computers and utilizing e-mail. However, students were forced to overcome their fear through cooperative learning when they were forced to download assignments and messages and were assisted by other, computer-literate classmates. Other students, however, expressed the opinion that this is the best way to get information. They indicated that this approach made them "feel like an adult" because "they can get the information on their own time". We were very surprised that the students did not indicate a strong appreciation for the internet movies and/or CD-ROM demonstrations in Guetzloff's survey (Tables III and IV, question 2).

CONCLUSION

Our findings are that student reactions to the incorporation of multimedia instructional materials into courses is not automatically nor overwhelmingly favorable. Acceptance depends on a number of factors, and perhaps key among them is the level of motivation of the student: science majors more readily used the multimedia materials than non-science majors.

Both approaches (using pre-packaged materials -vs- using the Internet) have both positive and negative aspects. Among the positive aspects is that either is readily accepted and used by motivated students, and that a core group of motivated and computer-adept students can and will enable nearly all students to utilize multimedia through cooperative learning. Most of the negative aspects deal with relative costs of implementation in terms of time and money, and these aspects will be discussed in a different forum and warrant no further discussion here.

Future areas of investigation will involve attempting to determine whether or not learning is enhanced in courses that incorporate multimedia when compared to courses that do not incorporate such materials.

However, just as we professors feel that the task of incorporating multimedia materials into our courses is something that has been added over-and-above our already existing job requirements, perhaps students see multimedia materials in much the same way - that it doesn't lighten their load at all, it is an additional requirement that has been added over-and-above the already existing course requirements that involve reading the textbook, attending class for discussion and notes, and the requisite reviewing prior to examinations. Thus, perhaps one implication of our findings is that if multimedia is to be incorporated into courses, that a certain time-allowance be given to students to use the materials, and perhaps this is an issue that is relevant to both faculty and administrators when deciding on the scheduling aspects of college courses.

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Table I. Responses from students in Dr. Sorenson's Biology 103 (science majors) course, Fall 1997.

I used the CD-ROMs		Total Number of Responses
A. a lot		16
B. a little		13
C. not at all		3

A. a lot		Why I chose "A"
# students		
10	a.	they provided better graphic illustrations and animation to enhance understanding of ongoing processes
3	b.	their graphics were very helpful in conjunction with the textbook
10	c.	they provided quizzes in which it didn't matter whether I got the answer right or not the first time
15	d.	they allowed review of topics that I didn't really understand from the coverage it was given in class
2	e.	other (the student provided their own written comments)

B. a little		Why I chose "B".
# students		
5	a.	I tried at first, but I'm so busy that using the textbook is enough
0	b.	I didn't make the effort/don't like going to the CAI lab at night
1	c.	the CD-ROMs really don't demand that much time input
1	d.	I hate computers
6	e.	other (the student provided their own written comments)

C. not at all		Why I chose "C".
# students		
1	a.	no time to go to CAI lab and do it
1	b.	CD-ROMs are difficult to use
1	c.	I hate computers
1	d.	I don't like the CAI lab
1	e.	other (the student provided their own written comments)

Table II. Responses from students in Dr. Sorenson's Biology 106 (non-science majors) course, Fall 1997.

I used the CD-ROMs		Total Number of Responses
A. a lot		1
B. a little		19
C. not at all		6

A. a lot		Why I chose "A"
# students		
0	a.	they provided better graphic illustrations and animation to enhance understanding of ongoing processes
0	b.	their graphics were very helpful in conjunction with the textbook
1	c.	they provided quizzes in which it didn't matter whether I got the answer right or not the first time
1	d.	they allowed review of topics that I didn't really understand from the coverage it was given in class
1	e.	other (the student provided their own written comments)

B. a little		Why I chose "B".
# students		
14	a.	I tried at first, but I'm so busy that using the textbook is enough
3	b.	I didn't make the effort/don't like going to the CAI lab at night
0	c.	the CD-ROMs really don't demand that much time input
1	d.	I hate computers
10	e.	other (the student provided their own written comments)

C. not at all		Why I chose "C".
# students		
3	a.	no time to go to CAI lab and do it
0	b.	CD-ROMs are difficult to use
1	c.	I hate computers
1	d.	I don't like the CAI lab
4	e.	other (the student provided their own written comments)

Table III. Student survey averages from Dr. Guetzloff's Chemistry 101 class during Fall 1997 semester.

Multimedia and WWW Page Survey Questions Posed to Students in Chemistry 101 (42 students total)	1*	2	3	4	5	Average of Student Responses
1. The computer classroom presentations were given in an acceptable manner.	14**	17	8	3	0	2.0
2. When multimedia movies were shown in the classroom, the demonstrations enhanced the learning process.	10	7	12	5	2	2.5
3. Did you like the high resolution of the computer graphics compared to an overhead projection of transparencies?	29	5	4	3	1	1.62
4. If you had a choice between an instructor that uses multimedia and another that utilizes "old fashioned" classroom techniques, would you choose the instructor that uses multimedia?	24	7	5	5	1	1.86
5. Did you feel that the email (listserv) questions were challenging and valuable?	7	9	20	5	1	2.62
6. Did you like receiving your homework via the listserv rather than wasting valuable class time with homework assignments?	12	10	12	5	3	2.45
7. Did you like receiving your announcements via the listserv rather than wasting valuable class time with announcements?	12	12	10	5	3	2.40
8. Did you like the feeling that our instructor was just several (computer) clicks away from answering your questions via email on weeknights, weekends, and holidays?	14	8	12	6	2	2.38
9. Did you like having the abridged class lecture notes on the World Wide Web?	14	9	13	4	2	2.31
10. Did the overall technology enhance your studies?	14	14	8	5	1	2.17

* - The numbers 1-5 correspond to highest agreement for 1 and lowest agreement for 5.

** - This number represents the number of students who chose that level of agreement.

Table IV. Student survey averages from Dr. Guetzloff's Physics 211 class during Fall 1997 semester.

Multimedia and WWW Page Survey Questions Posed to Students in Physics 211 (21 students total)	Average of Student Responses
1. The computer classroom presentations were given in an acceptable manner.	2.48
2. When multimedia movies were shown in the classroom, the demonstrations enhanced the learning process.	2.62
3. Did you like the high resolution of the computer graphics compared to an overhead projection of transparencies?	1.76
4. If you had a choice between an instructor that uses multimedia and another that utilizes "old fashioned" classroom techniques, would you choose the instructor that uses multimedia?	1.95
5. Did you feel that the email (listserv) questions were challenging and valuable?	2.95
6. Did you like receiving your homework via the listserv rather than wasting valuable class time with homework assignments?	3.00
7. Did you like receiving your announcements via the listserv rather than wasting valuable class time with announcements?	2.90
8. Did you like the feeling that our instructor was just several (computer) clicks away from answering your questions via email on weeknights, weekends, and holidays?	2.57
9. Did you like having the abridged class lecture notes on the World Wide Web?	2.14
10. Did the overall technology enhance your studies?	2.62

* - The numbers 1-5 correspond to highest agreement for 1 and lowest agreement for 5.