Multimedia in Political Science: Sobering Lessons from a Teaching Experiment

KENNETH JANDA
Department of Political Science
Northwestern University, Evanston, IL 60208, USA

Abstract College students learn something about American government when taught using multimedia techniques, but it is not clear what that is. I report a controlled experiment to test the effectiveness of a multimedia method of instruction in political science against two alternative methods. The findings based from this particular experiment raise some questions about designing multimedia applications to achieve pedagogical objectives. Given the considerable costs associated with multimedia applications, educators should evaluate their use compared with alternative methods of teaching. It is not enough to rely on students' statements that they enjoyed viewing videos.

"Multimedia" is the current buzzword in educational technology. It refers to combining different electronic media, commonly computers and videodiscs, in teaching materials. Computer vendors present dazzling images of multimedia applications in classrooms, and many teachers view multimedia as the way to reach today's generation of TV-oriented students. Unfortunately, the road of good intentions in educational technology is strewn with failed efforts.

One pioneer of computer applications to teaching in the 1960s became so disheartened by the lack of progress by the end of the decade that he wrote a critical essay, *Run, Computer, Run: The Mythology of Educational Innovation* (Oettinger, 1969). It criticized his earlier optimism and raised questions about the future of computers in transforming education in America. Of course, computing then consisted of mainframes and terminals, but the record of personal computers in education is also problematic today. Although a study by Sheingold and Hadley (1990) found hundreds of teachers in elementary and high school who used computers effectively, another researcher said that such imaginative usage is "extremely rare" (Becker, quoted in Chira, 1990, p. B6). Evaluating computing in the curriculum at a large midwestern state university, Glick argued that "the impact of computers on the educational process on our campus and others like it is marginal at best" (Glick, 1990, p. 35).

Perhaps multimedia, by relying on students' demonstrated fondness of television, offers a more robust technology that produces positive results more readily. Some advocates of the interactive video form of multimedia seem to say as much:

> A rapidly growing collection of evidence concerning the effectiveness of interactive video-based CAI [computer-assisted instruction] is accumulating; studies have shown interactive video to be the most effective mode of educational technology for teaching and learning. (Bailey, 1990, p. 82)

Some computer professionals outside the educational sector are more dubious of such claims. Commenting on the new book on interactive multimedia by Ambron and Hooper (1990), Shannon says:

> Many of us remember when personal-computer enthusiasts promoted the machines as devices that would revolutionalize education. They didn't. Multimedia programs represent a second chance. (1990, p. B9)

Having used computers in my college teaching with good results since 1961, I undertook a controlled experiment that might demonstrate the effectiveness of a multimedia method of instruction in political science against two alternative methods. The findings based from this particular experiment raise some questions about designing multimedia applications to achieve one's pedagogical objectives. To foreshadow those findings, I can say that college students learn *something* about American government when taught using multimedia techniques, but it is not clear what that is.

Research Design

From late March through May, 1990, I used three different teaching techniques at Northwestern University to supplement my lectures in the introductory course on American government and politics. The 10-week course was taken by 238 students, 80% of whom were freshmen or sophomores. All students had identical reading assignments from a common syllabus based on the text *The Challenge of Democracy* (1989), which I co-authored with Jeffrey Berry and Jerry Goldman.

I lectured to the entire class for 50 minutes on Mondays, Tuesdays, and Wednesdays. On Thursdays and Fridays, the class split into 12 discussion sections of approximately 20 students who met with one of four experienced graduate Teaching Assistants (TAs). Each TA taught about 60 students, employing a different technique in each of their 3 sections:

- In the **traditional** discussion sections, the TAs led the class in discussing material from the lectures and from the assigned readings. This is the standard method for involving students in group discussions when courses are very large.

- In the **computer** sections, the TAs began by asking for questions about the lectures and readings; then they initiated discussion based on the students' experiences with two programs that accompanied their textbook. The IDEAlog program (Hartman, Janda, & Goldman, 1989), used only for one week, helped students understand the nature of political ideology and allowed them to test their own self-classification by answering 20 questions. The rest of the quarter was devoted to the CROSSTABS 2.0 program (Schrodt & Janda, 1989), which won an EDUCOM/NCRIPTAL Distinguished Software Award in 1987. Students used CROSSTABS with self-contained

datasets to analyze the attitudes and behavior of 1,775 respondents interviewed for the 1988 presidential election and all 435 members in the 1988 Congress. They discussed their findings in their sections.

- In the **multimedia** sections, the TAs first asked for questions about the lectures and the readings; then they began discussion based on the questions the students had encountered after completing a hypercard-based computer and videodisc unit prior to attending the section. The interactive video (IV) activity is described at length below.

The students knew nothing about the sections nor the TAs when they enrolled for the course, so they chose sections only according to their time preferences. The sections were arbitrarily designated as to method only in the second week of the course, after students had completed switching sections to fit any schedule changes. Students were not informed beforehand that the course was being conducted as an experiment. Although many figured that out during the quarter, some were surprised to learn at the final examination that other students had done different things in their discussion sections.

According to a survey administered on the first day of class and analyzed by sections after the course was over, there were no significant differences among students in the three types of sections regarding (a) their reason for taking the course (25% took it because it was required), (b) their reported knowledge of American government, (c) their interest in the subject, nor (d) whether they planned to take another course in American government in the future. TAs ordinarily have a substantial effect on students' attitudes toward their discussion sections, but this time each TA taught each type of section. Given no differences among the sections at the start, any differences in the treatment groupings at the end of the course should be due to the method of instruction.[1]

Previous articles have reported significant results from research on the effectiveness of interactive videodiscs in teaching college-level subjects. In an article on using IV in teaching chemistry, Jones and Smith studied both a preparatory course for students with low placement scores and a second-semester course for engineering majors. They sought to determine how well students learned from their video lessons and how much they liked them. The authors state, "In all cases, we noticed significant gains for the students using the videodisc lessons" (1989, p. 85). A later article by Hardiman and Williams (1990) on teaching college arithmetic in a community college found that the students in the interactive video group were more likely to complete the course with a passing grade. Most recently, Bailey's study of community college students' performance on the mathematics portion of the College Level Academic Skills Test (CLAST) found that "utilizing supplemental computer-based and interactive video-based CAI resulted in a significant difference in CLAST scores, with the experimental group having the higher mean test scores" (1990, p. 85).

Some of these studies (like mine) were limited by design problems. Hardiman and Williams deplored "the lack of randomization" in selecting subjects, and Bailey's "experimental" group "used CAI and interactive video materials *in addition to* [italics added] the traditional lecture-plus-textbook method of instruction" used by the control group (p. 83). Even accepting these results, chemistry and mathematics are not political science, and there is still room to question whether the multimedia approach transfers well from the physical sciences to the social sciences. Moreover, there is also room for a controlled study with blind assignment of students to treatment groups and with multiple instructors employing each of the alternative teaching methods.

The Multimedia Application

The interactive video component of the course requires further description. Ninety minutes of video material covering events and personalities in American politics were culled from *The Video Encyclopedia of the Twentieth Century*.[2] With assistance from Pioneer Communications of America, this material was reproduced on three sides of two videodiscs in CAV format.[3] The resulting videodisc contained hundreds of brief film clips on five topics: (1) The Watergate affair; (2) Ideology, the Media, Participation; (3) Presidential Popularity; (4) Civil Rights and Equality; and (5) The Vietnam War.

To assess the value of incorporating these videos into the basic American government course, we submitted a proposal for this experiment to Apple Computer.[4] Apple graciously granted seven Macintosh SE computers and sufficient funds to acquire an equal number of Pioneer 4200 videodisc players and television monitors. Apple also supplied Macintosh Plus computers to the TAs to compensate for extra work in teaching their sections three different ways. The University Library cooperated by purchasing modular carrels to accommodate the multimedia stations and installing them in its Media Facility, where the students did their multimedia assignments.[5]

Assignments in the multimedia sections consisted of going to the multimedia laboratory once a week to run a "Democracy" hypercard stack that accessed the material on the videodiscs. My colleagues in Academic Computing at Northwestern University created a "videopath" authoring stack for linking the video frames with text on the computer screen.[6] I used the authoring stack to create videopaths for each of the five units. Each path contains background information about the video events that the student views and hears. Figure 1 reproduces the menu in the Democracy stack that each student sees on entering the program.

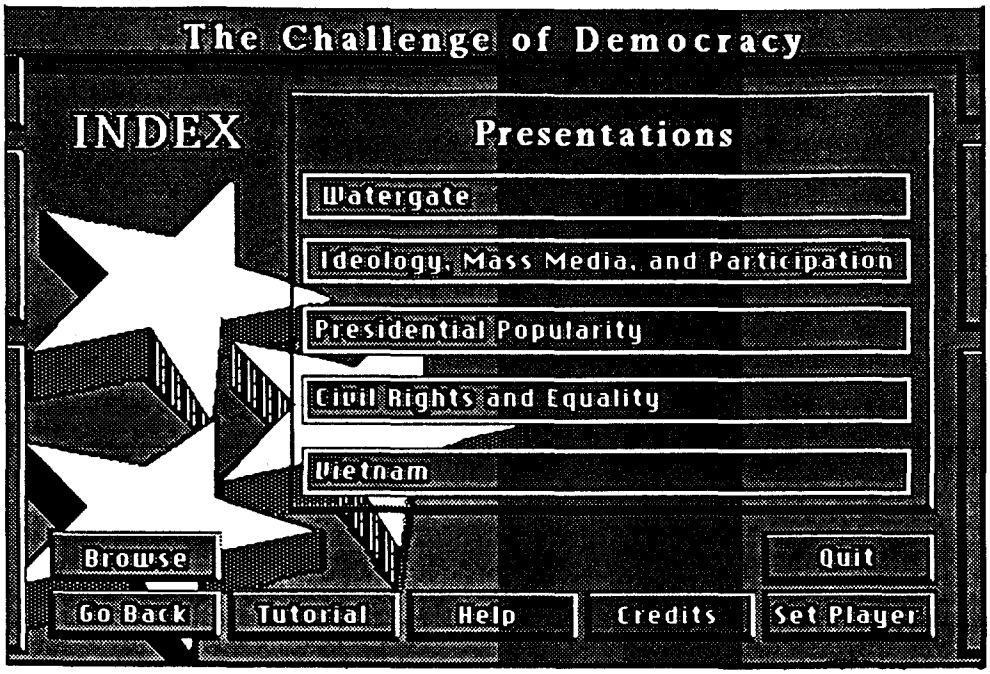

Figure 1. Opening menu for the democracy stack

The Democracy stack has a fully interactive "browse" capability that allows students to search for video clips on people and events and to display the videos at their option. Unfortunately, the CAV format limits the amount of video available on one side of a disc to 30 minutes of running time, which is not enough to support meaningful interaction on any of these topics. Moreover, students in the introductory course usually do not know what to look for nor how to interpret what they find. For example, few 18-year-old students know anything about the actual Watergate break-in, nor about Ron Zeigler, President Nixon's press secretary. So I created five guided tours to the video material that formed the weekly assignments for students in the multimedia sections. By clicking on one of the five titles under "Presentations," students select a videopath to one of the five units. Depending on the unit, these videopaths consist of varying numbers of computer screens and varying lengths of running time, as shown in Table 1.

Table 1
Video Units, Computer Screens, and Viewing Time

Videopath Unit	No. Computer Screens	No. Video Segments	Approximate Viewing Time
The Watergate Affair	36	23	35 min.
Ideology, Mass Media, and Participation	20	10	25 min.
Presidential Popularity	32	12	30 min.
Civil Rights and Equality	18	11	20 min.
The Vietnam War	17	8	20 min.

The videopath to the "Watergate" unit, for example, contains 36 screens of computer information keyed to 23 film clips, with the whole unit taking about 35 minutes to view. The unit begins by describing the physical break-in at the Watergate hotel complex (with accompanying video) and explaining the White House connections to the buglars. Subsequent screens discuss the key actors in the White House, and a video clip shows press secretary Ziegler denying any presidential involvement in the break-in. Information in other screens describes events leading to the Senate Select Committee hearings on Watergate and to key portions of those hearings.

Figure 2 reproduces one of the screens from the Watergate unit. This screen was accompanied by a film clip, lasting less than a minute, of Howard Baker asking his memorable query of John Dean, the discharged Counsel to the President. Other scenes in the videos include revelations from the White House tapes, the vote cast by each member of the House Judiciary Committee on the recommendation for impeachment on three counts, and President Nixon's last appearance at the White House before leaving by helicopter. The final video shows President Ford announcing his pardon of Richard Nixon.

Each unit concludes with a computer screen posing questions designed to elicit student opinions about the topic covered rather than "correct" answers. A typical example is, "Did President Ford act in the best interests of the nation by pardoning Richard Nixon?" Students were asked to write down these questions and to be prepared to discuss them in their Thursday or Friday discussion sections. The questions at the end of the Watergate unit are presented in Figure 3.

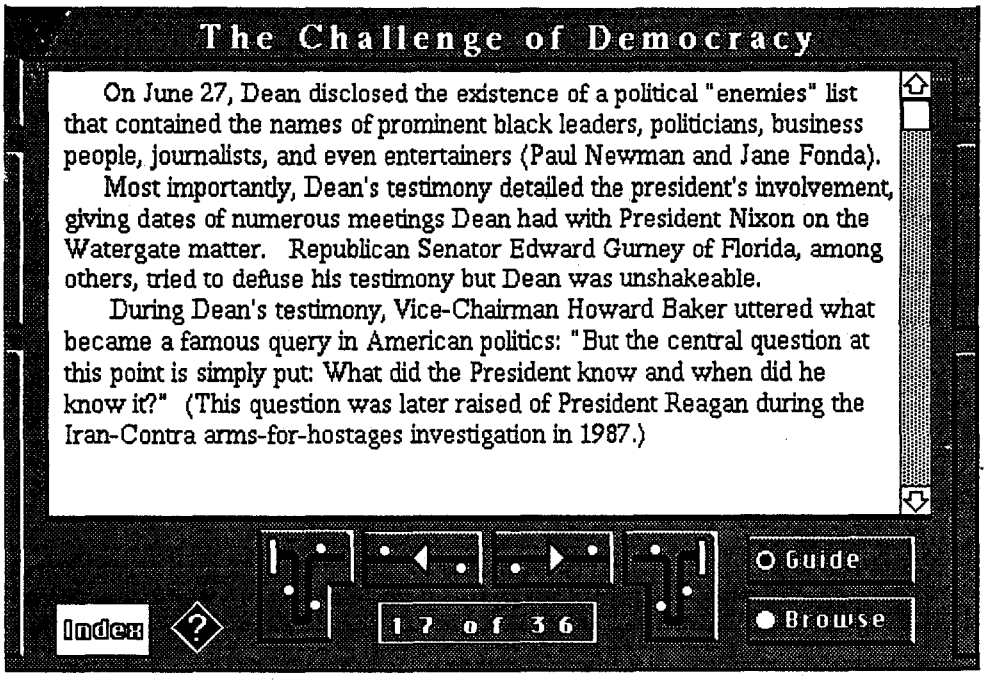

Figure 2. Computer screen preceding John Dean's testimony

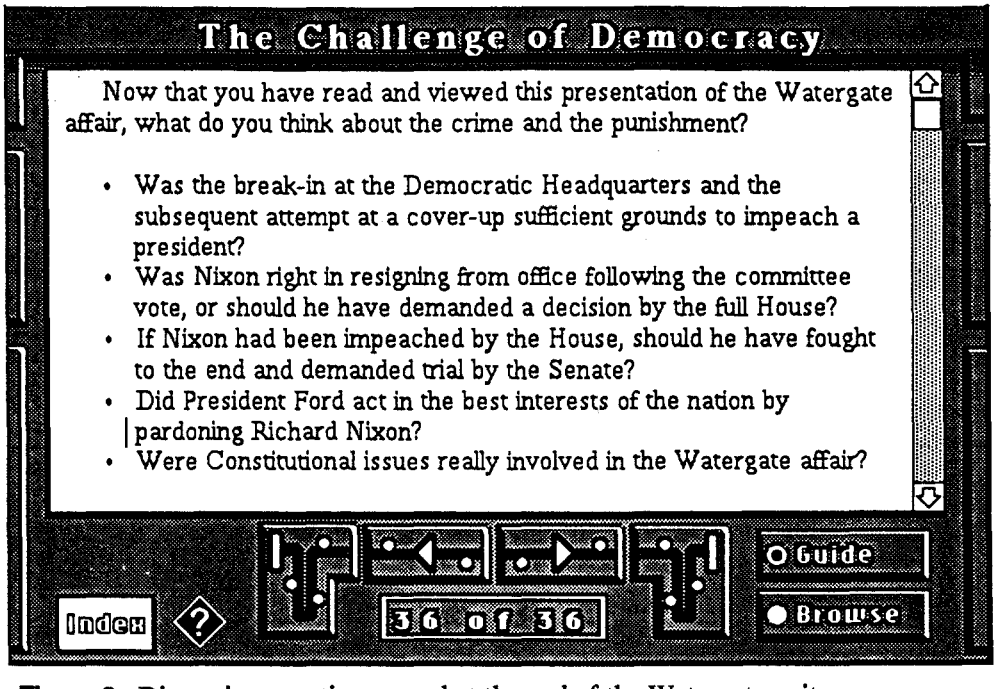

Figure 3. Discussion questions posed at the end of the Watergate unit

At the end of the course, students in the multimedia sections were asked which of the five videopaths "was most important to their understanding of American politics." The Watergate unit was clearly the most popular, chosen by 41%. Next was Civil Rights, with 27%; then Presidential Popularity (14%); Ideology, Media, and Participation (11%); and Vietnam (6%).

Evaluation of the Experiment

A great deal of attention was given to evaluating the results of this experiment. At the end of the quarter, students in all the sections were asked to complete another questionnaire that repeated several questions asked at the beginning of the term and that contained new items about their feelings toward the course. All students were also asked to write down "anything they liked or didn't like about the teaching method used in their discussion section." Those in the multimedia and computer sections were presented with additional items tailored to their particular experiences. Finally, four students were selected at random from each of the twelve discussion sections and invited to participate (for $5.00) in a "focus group" conducted by a professional interviewer to evaluate the course.[7]. Of the 48 invited, 25 students met for 90-minute sessions in one of three focus groups—one for each teaching method—with their discussions openly tape recorded. So we have a great deal of very good information with which to evaluate the experiment.

There is no question that students in the multimedia sections liked the video units. Data for 78 students who completed the special questions pertaining to the multimedia sections are reported in Figure 4. These results are quite remarkable: 93% agreed that "The realism of the video segments helped [them] understand complex events more than only reading or hearing about them"; 89% *disagreed* that "The video segments were not worth the time they took away from reading the text"; 82% agreed that "The videos helped [them] feel what others were experiencing in unfamiliar situations." Virtually everyone (99%) *disagreed* that "The program was difficult to use," and 89% agreed that they "enjoyed doing the computer and videodisc assignments." That's the good news.

The perplexing news comes from evaluating what students had learned about American government through exposure to the three teaching methods. I was prepared to find no significant differences in cognitive knowledge as tested on examinations. Disconcerting though it may be, different methods of instruction in the social sciences rarely yield significant effects when students are examined for knowledge of course content (see Ingram, 1987, pp. 27-31). In my course, students were graded on four factors: (a) an essay-type midterm examination (25% of the course grade); (b) a seven-page term paper—whose nature depended on the type of section (20%); (c) attendance and participation in their discussion sections and a short quiz based on the sections (15%); and (d) a 60-item multiple-choice final examination covering the entire course (40%).

In keeping with the research tradition, none of these factors displayed any significant differences among sections, based on an analysis of variance using the standard .05 level of significance. However, students in the traditional sections actually scored higher on the final examination, with a mean score of 45.4, compared with only 43.4 for those in the multimedia sections and 43.1 for the computer sections (significant at the .103 level).[8] (My finding of a *decline* in performance for students in the experimental group was also experienced by Casanova and Casanova (1991) in their study of teaching chemistry with an "electronic blackboard.")

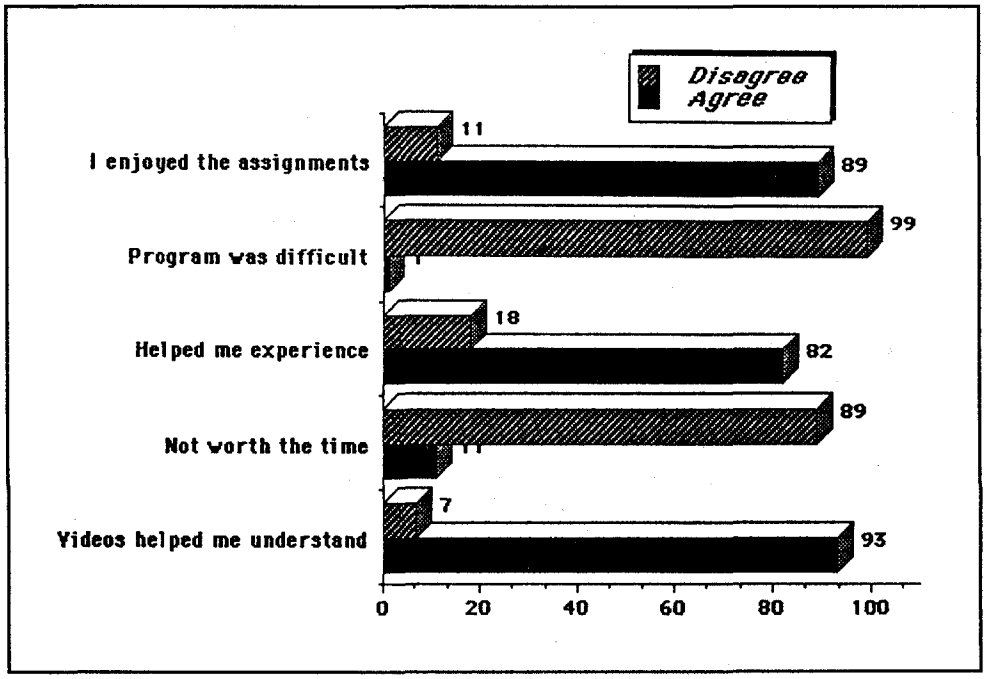

Figure 4. Student responses to viewing the videodisc units

From the beginning, my experiment was not expected to show any effects in students' cognitive learning from participating in either the multimedia or computer sections. Its research design counted on demonstrating positive effects by asking three questions that were not based on course content: (1) "How would you rate your knowledge about American government and politics right now?" (2) "How interested are you in American government and politics?" and (3) "Right now, do you plan to take another course in American government and politics?" The same students' responses to these questions on the first day of class were compared to their responses at the end of the course, and a paired *t*-test was conducted to test for statistical significance. Fortunately for my self-esteem, students within all three treatment groups showed highly significant increases in their self-ratings of knowledge about American government *after* taking the class (significant beyond the .0001 level, using separate paired *t*-tests). However, an analysis of variance showed no significant differences among the three groups in their post-course self-ratings. Ironically, students in the traditional sections rated their knowledge slightly higher than those in either computer section. For the other two criteria, students in the three groups showed no significant differences over time either in their interest in the subject or in their likelihood to take another course. In fact, students in the traditional sections were the only ones to be more, rather than *less*, likely to take another course. Moreover, analysis of variance showed no significant differences among the three treatment groups in either subject interest or likelihood of taking another course.[9]

According to these quantitative indicators, students in the multimedia (and computer) sections performed *no* better than those in the traditional sections (indeed a little worse) and displayed *no* distinctive interest in the course, *no* greater sense of knowledge, *nor* more of an inclination to take another course in American government.

Lessons from the Experiment

How can we square these results with the other quantitative measures of student opinions of their multimedia experience? The students' essay comments and the discussions in the multimedia focus group help explain how students could like their multimedia assignments so much yet not show any more positive reactions to the course. This information helps formulate two "sobering lessons" of this experiment:

Lesson 1: *Students distinguish between what they like doing and what they think helps them learn, and they hold a narrow view of learning.*

Findings from this study and from my previous research (Janda, 1987, 1989) show that students *like* to watch videos about American politics, but they readily concede that the videos do not help them "learn" as much as alternative techniques that they might not like as much. Consider some reactions to the Watergate unit, which was judged the "most important" of the five units in the multimedia sections. One student in the multimedia focus group said:

> I thought the videos were the highlight of the course. Very rarely am I willing to take out 45 minutes and do something extra, and I really liked it. Because it was so interesting I went to watch the first one and it was really cool, like you were almost alive when it happened cause you get to see it unfold.

> I already said that the videos were the best part of the course, but . . . it was a separate thing—I don't think it will help on the final and I don't think it helped on the midterm.

Another student wrote this comment on the survey form:

> I think that the discussion section should have focused more on class lectures and the text and not the video segments. The video segments on Watergate, for example, went very in depth into the affair. However, Watergate was not a great issue in the lectures.

Yet another in the focus group said, "The videos were very interesting" but they were "not going to help us on the final."

This was a common complaint among the students, who judged the teaching methods according to how they thought they would be tested on the lectures and readings at the end of the course. By this standard, those in the traditional sections were the most satisfied by their section experiences. Comments in the traditional section focus group are reflected in these two statements:

> I think what made our TA seem like he was doing a good job was because when we were discussing things and the midterm came, it was exactly what we had discussed. I think that's what the TA section was supposed to be, to go over things in detail that were supposed to be on the midterm.

> TA sections make you feel more comfortable about the class. You learn what is going to be on the test. That just reassures. If we didn't have a TA section, I'd get edgy because I can't always see him during office hours. It makes you feel more confident and assured about the class.

This finding is not unique to my class but conforms to research by Barrall and Hill (1977), who queried students about eight instructional options and concluded that students preferred the traditional lecture-discussion format over all other options. It is entirely possible that the "traditional" method, which simply allows students to discuss the course lectures and readings for an hour with a teaching assistant, has some unappreciated merits.

Lesson 2: *Multimedia produces other forms of learning that are not measured by performance in the course nor by expressions of interest, knowledge, or future course plans.*

Consider this comment from a student in the multimedia focus group:

> The stuff given in class was like the stuff you learn in class. The stuff in the videos—like Iran-Contra—more like historical . . . almost like experience. It's the next best thing to having been there. I thought it was almost more valuable than the course.

Another student said:

> My parents would have discussions and I couldn't relate. This was letting us know about different time frames. Other than Nixon was Tricky Dick. There's just a lot of things that you need to know that you can put things into comparison. If you didn't know about Watergate, you couldn't do that.

One student analyzed his own situation:

> I'll be honest, I am not really great at keeping up with current affairs [but] I am getting better. When I was in high school, I couldn't be bothered. One reason why I liked the videos so much is that it gave me something to discuss. I knew about the major events but I didn't really know any details. Well here I am in a theoretical class, and here is all this theory, and when the videos told me exactly what happened at Watergate, then I've got something to apply the concepts to.

Despite these positive assessments of the multimedia sessions, students in those sections did not translate their feelings into any greater interest in American government, any greater sense of knowledge of the subject, or any greater inclination to take another course in the field. This mirrors the experimental findings of Casanova and Casanova in using an electronic blackboard to study chemistry:

> Class participation (questions, comments, discussion) was unusually high, of better quality, and more stimulating than the lecturer had ever experienced in thirty years of teaching organic chemistry. Students were favorably impressed and asserted that they had a good understanding of the subject, particularly the visual representations of molecular structure. However, performance was poor on conventional examinations. (1991, p. 33)

Despite their high participation and positive reaction to the method of presentation, more than half the students in the experimental section dropped the course after the first quarter, whereas enrollment in the "traditional" section (which scored higher on all categories of tests in the first term) actually increased by one in the second quarter. The reseachers provide a thoughtful pedagogical analysis of their findings, concluding that "*the electronic blackboard conveys to students a different set of priorities within the discipline that may or may not be tested by the instructor but may be important in the student's future work*" (Casanova & Casanova, 1991, p. 38; italics in original). They suggest that students in the experimental group might compensate for their lower test scores by a greater capacity to visualize and manipulate molecular materials, but "we do not know it and do not have a good way of finding out" (p. 38).

Returning to American government, one suspects that the videos' ability to help students "experience" the event does benefit learning. If that is really true of multimedia in the social sciences, then its advocates bear the burden of identifying and demonstrating these benefits—and whether the results are worth the considerable investment in time to produce IV material and in the cost of the equipment needed for teaching with it.

Limitations of the Study and Conclusions

Several criticisms can be addressed to my study. Many students in the multimedia and in the computer sections who learned that they were doing something "different" were put off by the experiment. Several students in the multimedia focus group said that they felt like "guinea pigs," and students in both the multimedia and computer groups complained that it was unfair that they had to do something "extra." Obviously, these complaints would vanish if all students in the course had used the videos. One could also argue that my application, while multimedia, was not truly interactive but simply a form of "page-turning," and that a truly interactive application would produce better results. But, as Gay and Raffensperger note, it is not clear whether designs that "offer the learner greater freedom and multiple modes for accessing information" are preferable to a linear method of a classroom setting (1989, p. 58).

Another serious criticism is that the multimedia and computer techniques were used only in the discussion sections and not integrated into the lectures, which was precluded by the need to separate the treatment effects in the experimental design. Based on years of experience in teaching research methods, I am confident that I could generate more student interest in using CROSSTABS if I personally referred to it in my lectures. I suspect that this is true with the video units too. Moreover, there could be major flaws in the design or execution of the units themselves, despite the students' overwhelmingly positive reactions to their multimedia experiences.

Further analysis of the large quantity of information collected in this experiment may eventually explain why students in the multimedia sections did not react more positively

to the course than those in the traditional sections. Whatever the explanation, it certainly appears that teaching with multimedia in the social sciences does not produce the same robust results that others have found in the physical sciences.

Given these unpromising findings, multimedia advocates must assume a greater burden in demonstrating the value of this expensive educational technology. It is not enough to prove merely that students *like* multimedia applications. Researchers must also show that this teaching method contributes to learning—either in student self-reports of learning, or on tests of course content, or along some other dimensions of motivation or understanding. This will require more ingenuity than we have shown in our research to now. Moreover, these assessments must be conducted against *alternative* teaching techniques—not just by supplementing existing methods of instruction with multimedia components. My own effort to demonstrate these benefits in this experiment was disappointing.[10]

References

Ambron, S., & Hooper, K. (Eds.). (1990). *Learning with interactive multimedia.* Redman, WA: Microsoft Press.

Bailey, Z.T. (1990). CAI and interactive video enhance students' scores on the college level academic skills test. *T.H.E. Journal, 18* , 82-85.

Barrall, M.E., & Hill, D.A. (1977). A survey of college students' exposure to and preference for eight instructional options. *Research in Higher Education, 7*(3), 15-327.

Casanova, J., & Casanova, S.L. (1991). The computer as electronic blackboard: Remodeling the organic chemistry lecture. *EDCOM Review, 26.* 31-33, 36-39.

Chira, S. (1990, September 5). Do computers make better teachers? *New York Times*, p. B6.

Gay, G., & Raffensperger, E. (1989, September). Considerations and strategies in the design of interactive multimedia programs. *Academic Computing*, 24-25, 57-58.

Glick, M.D. (1990). Integrating computing into higher education. *EDUCOM Review* , 35-38.

Hardiman, B., & Williams, R. (1990). Teaching developmental mathematics: The interactive videodisc approach. *T.H.E. Journal, 17*, 63-65.

Hartman, D., Janda, K., & Goldman, J. (1989). *IDEAlog: A computer program for analyzing political values*. Boston: Houghton Mifflin. (This program is available for both Macintosh and DOS computers.)

Ingram, J.K. (1987). *Implementing and assessing computer-augmented-teaching in the large lecture course.* Unpublished doctoral dissertation, Northwestern University.

Janda, K. (1987). Computer-augmented teaching in large lecture courses: The case of American government. *Academic Computing*, 34-35, 42-44.

Janda, K. (1989, August/September). *Teaching American government in an electronic classroom.* Paper delivered at the Annual Meeting of the American Political Science Association, Atlanta, GA.

Janda, K. (1990). Videopaths to learning American government. *T.H.E. Journal,* 42-47.

Janda, K., Berry, J., & Goldman, J. (1989). The challenge of democracy: Government in America. Boston: Houghton Mifflin.

Jones, L.L., & Smith, S.G. (1989). Lights, camera, reactions! The interactive videodisc: A tool for teaching chemistry. *T.H.E. Journal*, 78-85.

Oettinger, A. (1969). *Run, computer, run: The mythology of educational innovation.* Cambridge: Harvard University Press.

Schrodt, P.A., & Janda, K. (1989). *CROSSTABS: A computer program for American government, Version 2.0.* Boston: Houghton Mifflin. (This program is available for both Macintosh and DOS computers.)

Shannon, L.R. (1990, June 12). Peripherals: The apt quotation. *New York Times*, p. B9.

Sheingold, K., & Hadley, M. (1990). *Accomplished teachers: Integrating computers into classroom practice.* New York: Bank Street College of Education, Center for Technology in Education.

Author's Note: Paper delivered at the EDUCOM '90 Conference, Atlanta, Georgia, October 14-17, 1990.

Footnotes

[1]I am grateful to my Teaching Assistants—Sung Gul Hong, Hoon Jaung, Todd Schaefer, and Paul Sum—who had to make three different preparations for their sections.

[2]CEL Educational Resources, 477 Madison Avenue, New York, NY 10022 (Telephone 1-800-235-3339). Ethan Cosgriff, then a graduate student in political science, identified many hours of material in *The Video Encyclopedia* that were relevant to American politics. CEL gave permission for a portion of these selections to be reproduced on a videotape distributed by the Houghton Miffin Company in conjunction with *The Challenge of Democracy.*

[3]Richard Johnson of Northwestern University's Language Laboratory created the original 90-minute videotape containing the material and then supervised creation of the videodisc at the Pioneer laboratories in Carson City, California.

[4]Philip Galanter, Manager of the Advanced Technologies Group in Academic Computing at Northwestern University, joined with me in submitting the proposal to Apple Computer. I also appreciate the support of George Sadowsky during his tenure as Director of Academic Computing.

[5]I thank Stephen Marek and Stuart Baker in the Library's Media Facility for their cooperation in this project.

[6]William Parod of our Advanced Technologies Group was mainly responsible for preparing the hypercard stack. Philip Galanter helped design the approach.

[7]The focus groups were conducted by Heather Thiessen, a PhD candidate in political science employed by DDB Needham Worldwide, a major advertising agency in Chicago. Ms. Thiessen had served as a TA in my American government course.

[8]This difference was sufficiently large that I added two points to the final examination scores for all students in the multimedia and computer sections to adjust for their participation in those sections.

[9] Some ceiling effects on the indicators no doubt lessened the pre-post comparison. Even at the beginning of the class, 81% of my students at Northwestern said that they had "much" or "very much" interest in American government, and 68% said that they would or "probably would" take another course in American government. It should also be stated that the students seemed to like the course. In the survey conducted by Northwestern's Course and Teacher Evaluation Council, 89% of the students responded, "I am glad I took this course," and 90% responded, "I learned a lot from taking this course."

[10] Despite these disappointing findings, Apple Computer allowed me complete freedom to report my results and even assisted me in doing so at EDUCOM. I am grateful to Apple Computer both for financing my study and for respecting my interest in disseminating its findings. I do not regard these results as the final word on this subject, and I am continuing my evaluation of student reactions to multimedia in American government.