Integrating Digital Technology into Classrooms:
The Making of Warp & Weft, Might & Magic, Mettle & Motherhood: An Electronic Exploration of American Women's History: 1640s to 1870s

Barbara K. Iverson
Teresa Prados-Torreia
Columbia College Chicago

Incorporation of the World Wide Web and the Internet into the fabric of public life has turned questions of whether computers and digital technology belong in classrooms into questions of how to integrate these technologies effectively to improve pedagogical practice. Our paper describes the collaboration of a women's history class and a CD-ROM multimedia production class to produce an interactive multimedia CD-ROM and a Web site, and some surprising observations about our interface metaphor and navigating in virtual space.

The project was completed at Columbia College in Chicago. As the major areas in this arts and communication college increasingly integrate computers and digital technology into their classrooms in response to the changing world of professional work, general education classes are still taught as lecture classes in "technology-free" classrooms. Our model attempts to change this in profound and lasting ways that can be easily accomplished within the usual constraints of scheduling, limited facilities, and the need for faculty development.

The Model

Our strategy is to pair up a traditional "content-rich" lecture/discussion class with a "technology-rich" computer production class to create a collaborative interactive multimedia project around the subject matter of the traditional class. For our first iteration, the classes were Women's History (Colonial to 1877) and a CD-ROM multimedia production class. A multimedia approach introduces an "almost three-dimensional" character to research-based activities, like the traditional term paper, whose future is being called into doubt (Evans, C.T. & Brown, R., p. 18.). Visual imagery, icons, and integration of meaningful graphics, sounds, and video files with text support student understanding of the textual materials and engage students in the work needed to complete the project.

By focusing on acquisition of content (the historical data) and strategic knowledge (the "how to" of interactivity and multimedia), higher cognitive levels of thinking are required of students as they construct an interpretation of the data that will communicate their ideas to their audience (Smith & Reiser, 1997.)

The Process

The "technology-rich" class, which is open to juniors and seniors who have had three or more computer classes and experience using Adobe Photoshop, Macromedia Director, was modified slightly to incorporate the "content-rich" class as "clients" who would provide the subject-matter for our collaborative, team-based production during the semester as shown below:

Course Goals & Objectives

Tech class (8-10 students in a networked computer lab with Internet access):

1. Develop leadership and cooperative skills.
2. Apply programming, graphic, organizational, and analytical skills in a production environment where time, talent, and task interact.
3. Learn to translate ideas about interface and navigation design into digital terms.
4. Produce a work series that shows engagement with principles of content and form presented in this class.
5. Make substantive, documentable contributions to group products.
6. Learn to estimate a production budget for similar projects.
7. See first-hand how a project is begun, developed, and brought to production in a real-time way.
8. Be able to map the navigations & branches of our project.

Women's History Class (25 students in a classroom with a chalkboard and desks; access to general-purpose computer labs):

1. Students are assigned to write four two-page papers, which are to include non-textual components. Teams of five students working on similar research subjects are formed.
2. Teams work together to combine their individual research papers into a single document that they then mark up with "hyperlinks" in the case of words or phrases that need a definition or other text annotation, and they identify stories or important points that can be illustrated with an image, map, quote, song, etc.
3. Enhance students' computer skills by providing a few sessions of computer orientation in the lab.

Hardware & Software

In the classroom:

1. Power Computing Macintosh (32 MB RAM/2G ROM) with internal zip drives
2. Network storage for students and the class
3. Access to Netscape & Internet Explorer browsers (WWW, email)
4. Scanner
5. Networked printer

Software:

1. MS Office
2. Adobe PageMaker
3. Adobe Photoshop
4. Adobe Premier
5. Macromedia Director
6. Macromedia Authorware
7. SoundEdit
8. Fractal Painter
9. HTML editors (Communicator, PageMill)

The paired classes did not meet concurrently, but had an overlap between their meeting times. They met together four times during the 15-week semester, and the teachers made several additional visits to their partner's class.

Teaching assistants, students from the respective classes, had no special training, but were chosen by the faculty members based on their skills and interests. The TAs answered basic word processing questions for students and oversaw the exchange of research papers, which became somewhat confusing because history students could re-write their papers, allowing "versionitis" to creep into the project. In the future, we will use a document tracking system to prevent confusion.

Using email and a Web site to communicate between class meetings, and having network storage space for shared files, was essential to the project's success. The tech class was mapping images to ideas while the idea space was being written by the student content providers via their text-based research. Navigable interactive data exhibits (branches) were generated by this collaboration.

This was a risk-taking experience for the faculty, because the educational outcomes of the process had to be negotiated among the students, faculty, and classes and determined by the dynamic established between the students and teachers. The product was an unknown quantity as well, though it was our view that process was even more important than product. Additionally, interactive multimedia is not well understood in the academic community beyond the surface level, so one's work can be easily misunderstood. Students create wonderful images, but would they be historically accurate reflections of the content being developed by the history class? This came up, but as the tech students realized that their work must please the "clients," they read the research papers and began to fit their imagery to the ideas.

One of the tech students created a graphic interface for the colonial branch of the program. The class critiqued it and approved of it. However, when our "clients" came to view it, the history teacher saw the historical anomaly right away: a woman of the 1840s plains culture stuck in a collage about the colonial years. We modified the image; the experience was valuable (Figure 1).

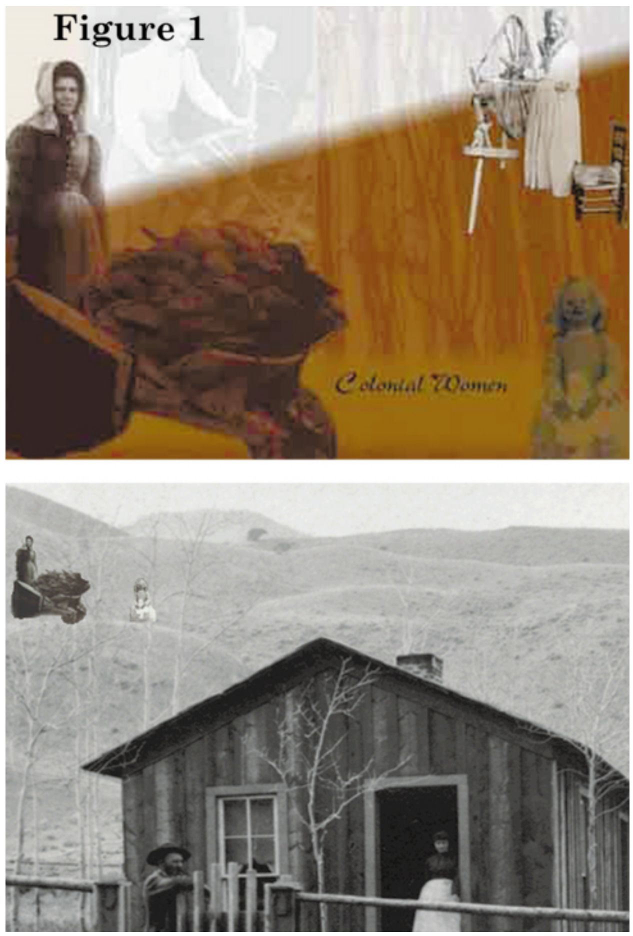


Figure 1

The constructivist orientation of the classes stresses teamwork and knowledge creation based on facts and other data developed by the students themselves. Traditional term papers are one-to-one communications – the student writes and the teacher reads. When students make their own interactive multimedia it implies an audience or "other." Creating a project for an audience provides opportunities for perspective-taking on the part of the student artist/researchers. This develops higher-order reasoning skills (Iverson, 1997). Research and technology skills transfer to other subjects and classes that students take. This kind of "learning by doing" helps students create cognitive webs or nets that lead to deep and full understanding of a subject (Smith & Reiser, 1997; Woltz & Palme, 1997). Furthermore, students get a sense of pride and ownership about their abilities as scholars and their mastery of the content.

We observed that history students' writing increased in length and complexity over the semester, while the tech students learned history in order to produce meaningful graphics and interactivity. Furthermore, tech students developed problem-solving skills because they were learning computer applications to use as tools for organizing ideas and content. They were motivated to get something done, and did not wait for step-by-step instruction from a teacher. Students used the teacher as a resource, but also learned to communicate with each other about technical matters. Learning became student-centered, not teacher-dictated.

The students' ambitions on this project were limited in the main by the time constraints of a semester, rather than the constraints posed by a structured syllabus.

Students completed a beta version of the project by the end of the semester. However, several of the students tested the beta CD-ROM, and within four weeks of the semester's end a completed version was ready for professional mastering. The professional mastering was done because we need several copies of the CD-ROM for each of the students and teachers who participated (about 35 individuals), and that is too many to do as a series of one-offs. Professional mastering also gives the students a sense of closure and accomplishment, and will provide a lasting resource for history classes at Columbia College.

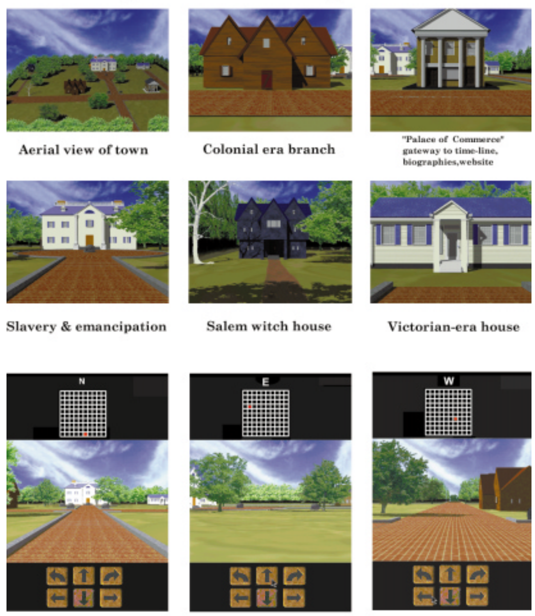
Choosing a design metaphor for our project brought us interesting information about the general level of understanding of navigation of virtual spaces and the importance of paying attention to one's audience. The tech class had to decide who we were designing our work for. We concluded that our audience was typical high-school-to-college-age students who would "have" to sign up for history. We were not making this a professional research tool, nor a piece that was aimed at a general audience as an encyclopedia might be. To attract the interest of our user, who we presumed to have an initially low interest in the topic (and parenthetically to interest some of the production students who themselves fell into this category) we developed a 3D fly-through of an historical "town" where each of its buildings would represent an era and one of our content branches (see Figure 2). Research suggests that play is a human adaptive behavior which encourages extended practice and experimentation that enables learning (Iverson, 1982.).

Navigation of the town provided users with directional arrow buttons and an orientation indicator of their locations (Figure 2). There was no way to "jump out" of the navigation and see how many houses there were. It was up to the user to explore. Little historical context was given at this point, as our users would be expected to have little knowledge. We aimed to pique their interest with the "game-like" front-end of the program, and then once they were in a branch of the program, provide them with more content. In this way, users construct an understanding of the virtual space they are navigating. This can be frustrating, but can also encourage users to spend time in an effort to make sense of the virtual space. We felt that the more time our users spent in our "town," exploring its branches, the more history they would learn.

This interface worked for the target users, unless they were complete computer novices. Novices were slow to have any interaction with the computer, and the interface requires interaction to "learn" about it. An un-expected problem arose from this design however. When we invited other faculty and administrators to try out the piece, we discovered a generational gap in understanding navigation of virtual spaces. The faculty (mainly over 30, and not accustomed to electronic gaming) found the navigation difficult. In fact, some believed it to be faulty. The houses weren't labeled, they "couldn't go anywhere" in the interface. They wanted to move directly to the content. There was confusion among these users on how the map-locator grid related to the navigational arrows (Figure 2). The faculty were not willing to navigate the town to see how many houses there were and had trouble accepting the ambiguity of not knowing exactly where they were going. They said, "How will I know if I have found all the houses?" They craved linearity. Younger users explore virtual space and more naturally construct cognitive maps of the virtual space. It is a second-nature skill to the younger users. This "sense of virtual place" is not developed, or not comfortable for older or less experienced users.

I believe the ability to move around in this interface depends on practice and

Figure 2 Interface & Navigation Details



Navigation in several virtual directions

experience in navigating virtual worlds. I tried this interface out with some 12-year-olds, who critiqued it in terms of its having "invisible walls," which are boundary areas of the virtual space where the programmer has not provided any visual feedback that a boundary exists. I had never heard of "invisible walls," but it is obvious that in any virtual space, there would be boundaries and that the programmer must "do something" at those boundaries (we provided a warning "beep" but no visual clue like a wall or warning sign). However, for the avid virtual "trekkers," this condition had been observed often enough that it had a name and was well-known to them.

This source of confusion between the design aims, audience experience level, and members of the academic community was unanticipated, but extremely interesting. It was of concern to me as a faculty member because my work with my students might be viewed as "faulty" instead of "targeted to a specific user community." We are going to provide a button on the interface navigation screen where those who are not cognitively ready for unaided virtual navigation can find an explanation of each "house" and will be able to tell how many houses there are. I expect that if I could collect "cookies" on who uses that button, it would tell the story of generations.

Conclusions

Most commercially produced CD-ROM software targeted to a mass audience costs from $100,000 to $300,000 per title and requires sales of millions of copies to make money. These costs discourage educators, artists, or community groups who seek to use "new media" as a form of communication. The commercial mode of production divides the viewer and producer, rendering the producer "invisible" and the viewer a "receiver" rather than a "participant." The viewer "interacts" with information that has been generated and organized by others, including information that might have been omitted. The user does little more than "look" at the piece. Knowledge is given to, not constructed by, the user.

However, when students participate in constructing interactive multimedia, it is a powerful educational experience. It yields information to students as well as experience in a collaborative team effort because it requires students to: a) generate and analyze information (text, images, sound, combinations of these), b) use meta-cognitive thinking to design the topic for interactive presentation, and c) take the audience perspective to design links, branches, and connections.

Given the widespread availability of the Internet and Web browsers that make interconnectivity between computers simple, addition of interactive multimedia presentations to course requirements at all levels of education becomes a natural enhancement of good teaching methods (Evans, C.T. & Brown, R.). The diffusion of computer skills that results from using the digital technologies as tools of production rather than as ends in themselves benefits everyone in a school. For our students to realize the mission of the college, to be the "authors of the culture of their time," they must be able to communicate effectively in the lingua franca. The pedagogy of new media is student-centered, user-friendly, and a must for our future.

Teachers have always had to teach content as well as "mechanics" (grammar, note-taking, proper attribution of source material, spelling, etc.) in any class. When computer and digital technologies are considered to be computer-mediated communication tools, and interactive multimedia is seen not as something new, but as a recent development along a continuum that began with cave painting and includes the illuminated manuscript, Guttenberg's Bible, radio, television, and film, then integration of technology into classrooms as described in this paper can be put in perspective. It is easier for students to use this technology than teachers expect (Evans, C.T. & Brown, R.), though our experience with the interface metaphor suggests that getting teachers to understand new media may be harder than we expect. More research in this area is needed.

Future Directions

We plan to continue our collaboration. We are going to provide more specific instruction in using the Web as a research tool for both classes. Content class students will synthesize their work, including identifying hyperlinks and possible images and quotes that could be recorded as sound bites prior to submitting the work to the tech class. Computer students will concentrate on some programming tasks and an analysis of the work we completed in prior semesters for several weeks before they begin working with the history content, or generating images for it. This will assure that the history students have been able to provide enough content for the work to begin. This was a problem in the first iteration, where we started off on production without having the content firmly in place.

We would like to extend this collaboration to more teachers and departments. We are working with our college's technology committee in order to secure more general purpose computer labs, as well as multimedia, presentation-ready class rooms. Our Web site will be extended with new content and improved as time goes on.

References

Evans, C. T. & Brown, R. Teaching the history survey course using multimedia techniques. In AHA Perspectives, Feb. 1998.

Iverson, B. K. Praxis What You Teach: Making Interactive Multimedia around Diversity Issues & Topics. in Gardaphe, F. (Ed.) 1997.

Iverson, B. K. Haha, Aha, Ah: A model for appraising play in curricular inquiry and evaluation. Center on Evaluation, Development, and Research, I982, No. 15, (2), 3-4.

Smith, B.K., & Reiser, B. J. (1997). What should a wildebeest say? Interactive nature films for high school classrooms. In Proceedings ACM Multimedia 1997, (pp. 193-201). The Association for Computing Machinery, New York: NY, 1997.

Wolz, U., Palme, J., Anderson, P., Chen, Z., Dunne, J., Karlsson, G, Laribi, A., Mannikko, S., Spielvogel, R, and Walker, H. (1997) Computer-mediated communication in collaborative educational settings. (pp. 51-69) SIGCUE Outlook. 25, (4), 51-69.