Learning Interactive Videodisc Development: A Case Study

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Abstract. This article describes the development of an interactive videodisc in a graduate course. Design of interactive video and instruction about interactive video are discussed.

Introduction

Interactive videodisc is fast becoming an important medium for instruction. The growing need for instructional design programs to train professionals in interactive videodisc development has been stressed by Allen and Erickson (1986), who also described a graduate course in which students obtain interactive videodisc development experience.

This article describes a graduate student interactive videodisc development project. The project is described both qualitatively and quantitatively for two purposes: (1) to make recommendations concerning interactive videodisc production, and (2) to make recommendations for teaching graduate students in Educational Technology programs how to develop interactive videodisc instruction.

The Program

During the 1985–86 academic year, five students in a graduate course on interactive video design and production developed an interactive videodisc for the University of Iowa College of Education. The college provided a $3000 budget for the production of a "kiosk" type informational videodisc with both a level 2 program and a level 3 program. The level 2 program is stored directly on the videodisc and controls the videodisc player without an external computer. The level 3 program is stored in an external computer which provides more flexible control of the videodisc player. In addition, computer text and graphics can be displayed with the prerecorded audio and video material on the videodisc.

The College of Education videodisc contains interviews of chairpersons from each of the departments in the college. It also contains scenes of faculty, staff, and students in the various departments teaching, doing research, and using college resources. It is a 30-minute videodisc with 27½ minutes of motion video, 95 different still-frame images, and an additional 15 minutes of audio on the second audio track.

Participants and Facilities

The students who participated in the videodisc development project had experience in educational television production and computer-based instruction design, but they had never produced an interactive videodisc program. Project guidance was provided by an instructor and others with interactive video experience. The instructor assisted the students in refining program goals and reviewing products; however, the students were given considerable latitude in making design and production decisions. The College television studio had the equipment needed to produce the original videotape for the program, with the exception of that required for still-frame editing and duplicating onto a one-inch videotape master.

Procedures

Phases of Development

The instructional development model used in the project was based on Wright's (1984) task analysis, with additional considerations from Iuppa (1984), Floyd and Floyd (1982), DeBloois (1982), Daynes and Butler (1984), and Alessi and Trollip (1985). The major phases of the model were (1) planning, which included analysis of needs and possible solutions; (2) instructional design, which included production of scripts and flowcharts; (3) production, which included parallel preparation of audio and video, computer programs, and documentation, and (4) evaluation, which included review, pilot testing, and some revision of the computer programs and documentation.

Data Collection

Students were required to maintain time and expense logs of all their project activities. Each entry included the date, the time spent, the expenses incurred, the persons involved, and a description of the activities completed.

The student logs were the basis for calculating the development time for various project activities. Students were required to record activity data at the time they engaged in any activity. Additionally, logs were checked periodically by the instructor to ensure that they were accurate and up to date. Logs of different students were cross-checked to further ensure the accuracy and validity of the data.

Design and Development of the Program

Planning. Planning included allocation of project tasks, determination of the project timeline (Figures 1 and 2), selection of equipment and computer programs, formulations of program goals, discussion of clients' expectations, and meeting with people to be videotaped.

Instructional Design. The major activities in the design phase were script writing and flow chart preparation. A computerized script-writing program was used to produce a scripted storyboard. The scripts specified all video, computer display, audio, and program branching. Two scripts were developed, one for the Level 2 program and one for the Level 3 program.

Program flow charts were also produced. The flow charts depict the general structure and sequence of the Level 2 and Level 3 programs. Although scripts provide a detailed delineation of branching that is particularly useful for programming, flow charts provide a graphic summary which is especially useful during planning and evaluation.

Video Production. Some students produced the video segments for the videodisc at the same time that others produced the computer programs that control the videodisc player. Video segments were recorded in faculty offices, university classrooms and laboratories, elementary and secondary school classrooms, and in other college facilities. All recording was done on three-quarter-inch videotape. Approximately 20 hours of unedited footage was recorded. Unedited video footage was shown for approval to clients and to the people recorded and some footage was rerecorded. A detailed edit was done on paper indicating what source material would be edited to exactly which sections of the master videotape.

The 30-minute master videotape was assembled from many sources, audiotape, slides, videotapes, 16mm motion pictures, a character generator for text and graphics, and a video switcher for special effects and titles. Still images, such as slides, were inserted at multiple locations to facilitate quick access on the videodisc.

Programming and Documentation. Level 3 programming was done in the BASIC programming language, with calls to machine language for computer text and graphics and for control of the videodisc player.

The Level 2 program was developed using an assembler which converts source code to machine language object code, downloads it to a videodisc player, and generates printouts appropriate for the production of a Level 2 program.

Both computer programs were tested extensively with an existing commercial videodisc. That is, the computer programs were tested with the presentation equipment but using an existing videodisc in order to assess the accuracy and speed of frame searches, the overlaying of computer text and graphics on the video display, and user control of the program.

A user manual was produced with directions for setting up the presentation equipment, starting the program, and controlling the program using either the videodisc player's hand controller (for Level 2) or the computer keyboard (for Level 3). Emphasis was on keys to press to begin the program, to freeze and resume action, to return to menus, to select program sections, to get help, and to exit.

Mastering and Evaluation. A check disc was obtained and reviewed. A log designating the exact frame numbers of still frames and the beginning and ending frame numbers of action segments was prepared. The log was used to finalize and test the computer programs. The check disc was also inspected for video and audio quality. Minor errors such as poor edits were found, but did not merit remaking the master tape. After the Level 2 program was thoroughly tested, its printout was sent to the videodisc production facility along with directions for videodisc duplication.

Videodisc production required three weeks. Each student was assigned to assess a different aspect of the program on all videodisc copies produced: audio quality, video quality, the Level 2 program, and the Level 3 program. Some discs were returned and replaced due to audio or video defects.

The Level 2 and Level 3 programs were pilot tested with users unfamiliar with the videodisc. Feedback concerning the Level 3 program was used to modify it. Since the Level 2 program could not be changed without remaking the disc, problems found in it, primarily unclear directions for use, were corrected by modifying the user manual.

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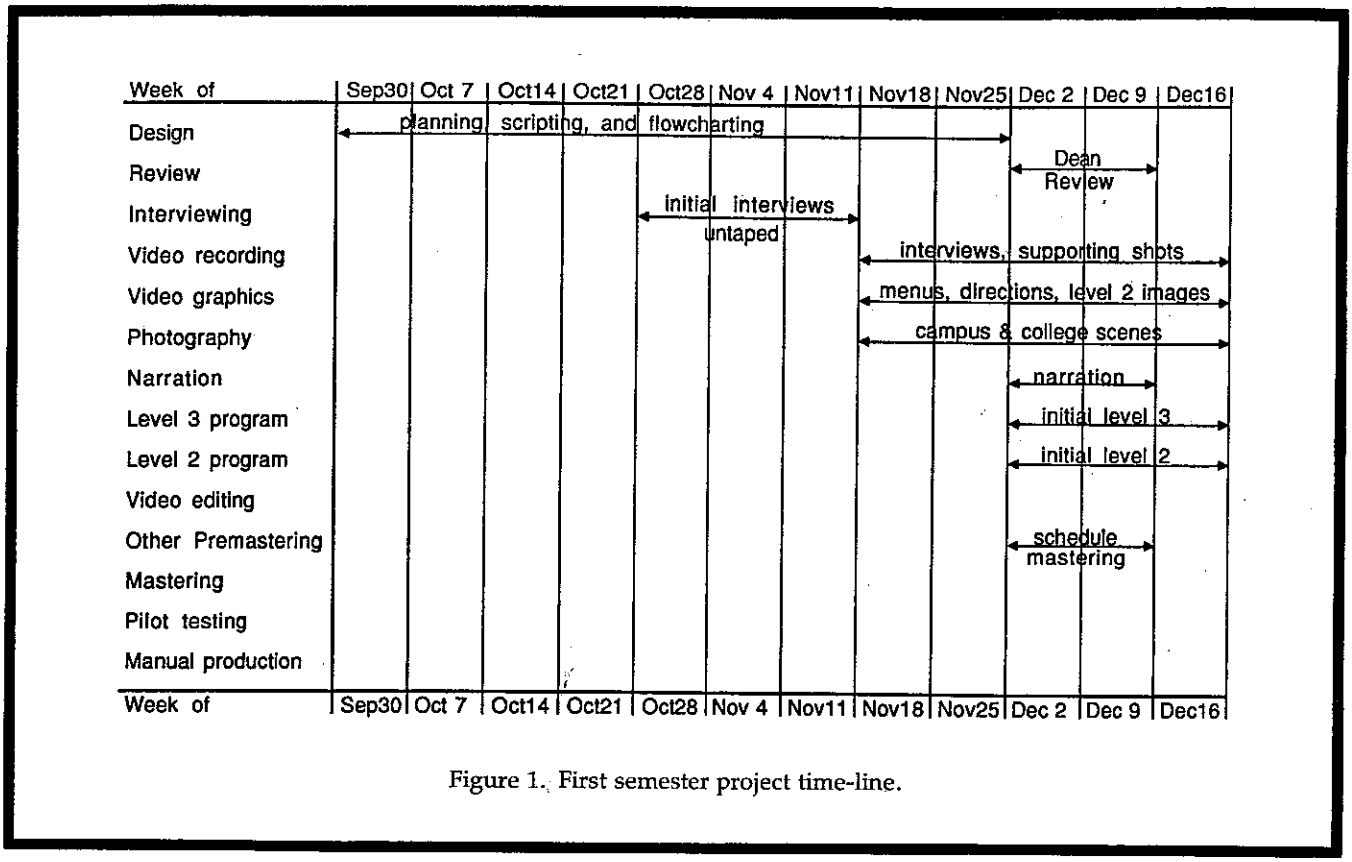

Figure 1. First semester project time-line.

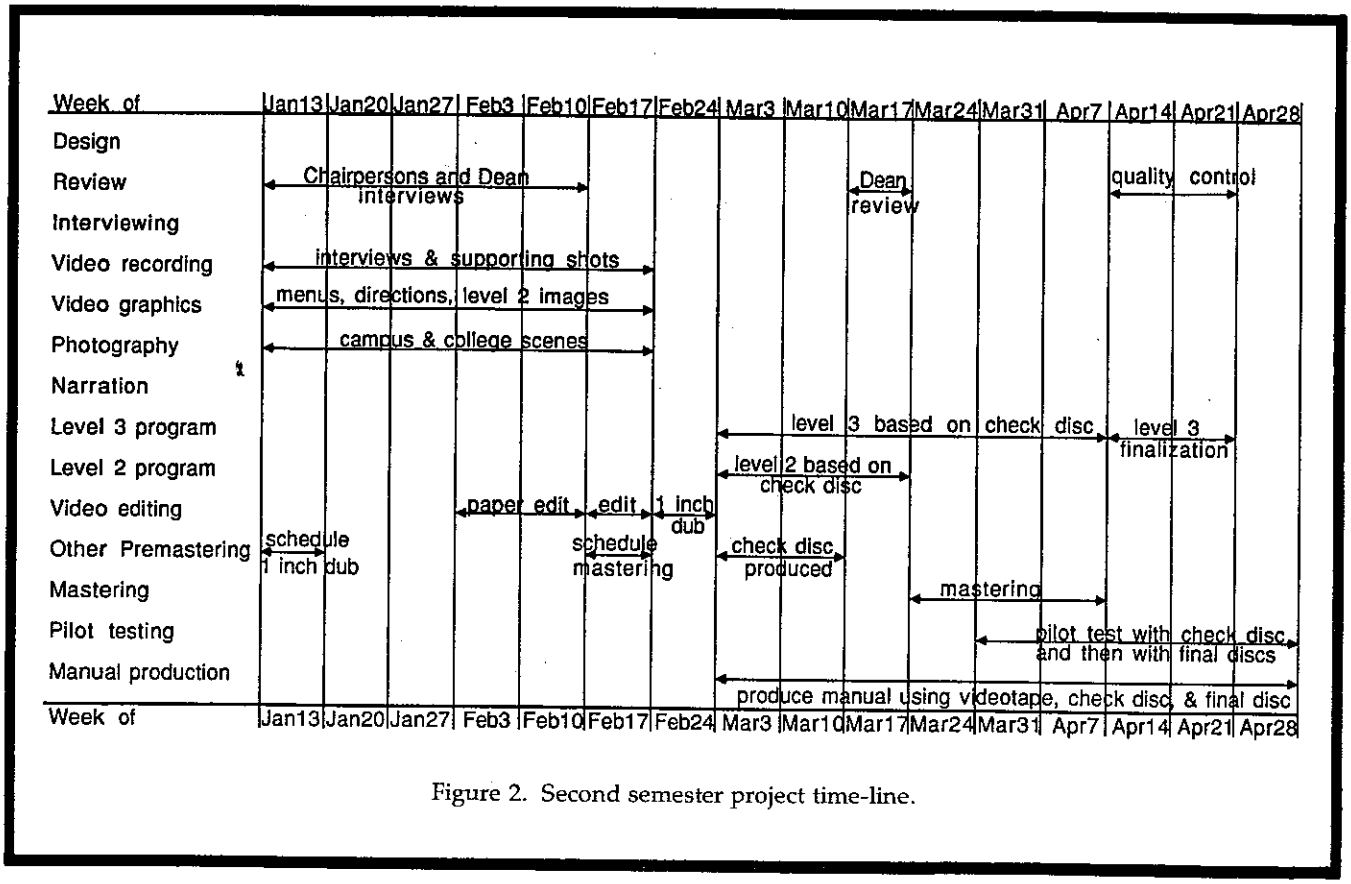

Figure 2. Second semester project time-line.

Results

Design and Development Time

Analysis of the student's time and expense logs indicated that a total of 1579 person-hours were needed to design, produce, and evaluate the finished videodisc programs. The percentage of total project time devoted to each development phase is shown in Figure 3.

Planning required approximately 92 hours, or 6 percent of the total project time. The scripts totaled 346 pages for the Level 3 program and 230 pages for Level 2. Scripting required 416 hours and flow chart preparation 28 hours. Including miscellaneous activities, instructional design required 472 hours, or 30 percent of the total project time. Audio/video production took 262 hours, photography 9 hours, and editing 203 hours for a total of 474 hours, or 30 percent of the total project time. Level 3 programming required 329 hours, Level 2 programming 78 hours, and documentation 38 hours, for a total of 445 hours, or 28 percent of project time. Review and evaluation required 96 hours, or 6 percent of total project time.

The reader should compare this to the conventional wisdom for development of standard computer-based instruction, which varies from 100 to 500 development hours per hour of presentation time. The presentation time for this program, combining both the Level 2 and Level 3 versions, is about 90 minutes. This project, therefore, represented about 1000 development hours per hour of presentation.

Students, especially those with previous video production experience, must learn the different requirements for scripting an interactive videodisc.

Cost

Expenses and activity times for the project are shown in the first three columns of Table 1. Because the majority of personnel were graduate students, no actual costs were incurred for their labor. But for most projects, all activities and facilities have associated costs. Based upon a rate of $40 per hour for video design and production, the fourth column shows *potential* expenses had commercial services been purchased. The actual costs incurred producing the program were $2542. Commercial services would have added an estimated $63,160. Professional services might, however, accomplish tasks in less time. Cost will vary widely, depending on the specifics of a particular project.

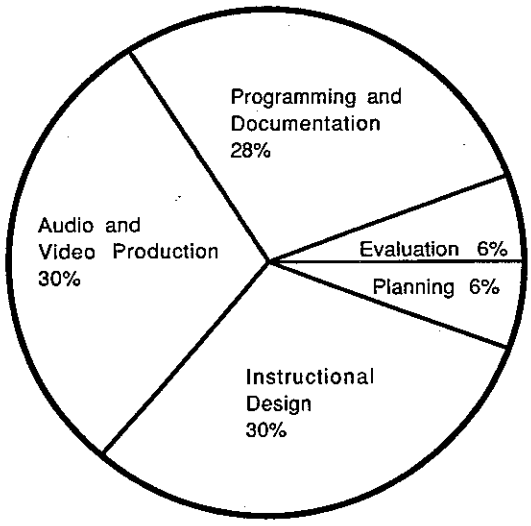

Figure 3. Percentage of total project time for each activity.

Successes and Shortcomings

Overall, the program met the clients' expectations of clarity, ease of use, and content accuracy. There was some dissatisfaction with repeated use of some spokespersons in the program and with incongruities between the persons shown in the program and the departments being described.

These shortcomings were due primarily to a lack of design detail in the scripts. For example, names of the persons seen in accompanying visuals were not always specified, so redundancy was not caught early. As another example, the students with standard video production experience argued against detailed scripts of interviews, insisting an interview is under control of the person being interviewed and cannot be scripted word for word.

The class was allowed more leeway in the aspects of design than was perhaps wise. Students, especially those with previous video production experience, must learn the different requirements for scripting an interactive videodisc. Even interviews must be carefully scripted because of the exact

TABLE 1

Activities, expenses, times, and estimated expenses.

Activity or Service	*Actual Expenses Incurred*	*Actual Person Hours*	*Estimated Additional Costs*
Planning		92	3,680
Instructional design		472	18,880
Audio/video production			
Facilities and personnel		474	18,960
Video tape	230		
Narrator	50		
Film and processing	111		
Dub/edit 1 inch tape	150		
Programming and documentation			
Level 3		329	13,160
Level 2		78	3,120
Manual and documentation		38	1,520
Review and evaluation			
Facilities and personnel		96	3,840
Check disc	375		
Mastering	1,500		
Seven disc copies	126		
TOTALS	$2,542	1,579	$63,160

30-minute limitation of disc space. Audio and video fades or other scene changes must be exactly described and of precise length to capitalize upon the random access capability of videodiscs. The required precision can be accomplished by an iterative process of initial planning, review or rehearsal, and revision. For example, a draft script may loosely specify the content of an interview. After a "rehearsal" interview, the script may be revised to permit precise timing and selection of accompanying visuals. The final interview may then be practiced and recorded.

In a professional project, client concerns should be detected early in the design process. Although the clients approved portions of the video and narrative material at an early stage, the students failed to have them review a draft of everything. At one point the director of the television studio and the instructor did review everything, and noted the talent redundancy problem. Revision was not demanded due to a tight time schedule and because it was a student project.

Some of these problems were also due to recording in natural field situations, such as elementary schools, where little control can be exercised over what occurs. Although 20 hours of videotape was recorded, this was too little for quality video of sufficient variety for a 30-minute presentation.

Discussion

What Should Be Done Differently?

The problems described above, and some others, could be eliminated by thorough adherence to the following guidelines. These are things especially likely to be overlooked by novices to instructional design.

Scripting. Interactive video requires much more detailed scripting than linear video. Synchronization of video, narration, and computer displays must be precisely described.

Video Production. Shooting must follow the script very carefully and be coordinated with computer text and graphics. Time must be allowed for reshooting. Video intensity, color saturation, and audio levels must be planned and kept uniform. A detailed paper-edit is necessary before on-line editing occurs.

Editing Equipment. Still-frame production with standard videotape editors is unsatisfactory. Equipment is recommended which stores still frames in memory and transfers them at 30 frames per second to the master videotape.

Computer Programming. A severe problem in Level 3 programs is synchronization of video and computer images. Synchronization should not be based on either timing loops or the computer's internal clock, due to variations between computer speeds and videodisc player speeds. The most reliable synchronization method is for the computer to read the videodisc player status and frame numbers. Hence, videodisc players not capable of returning frame numbers to the computer should not be used for Level 3 programs.

Selection of Hardware and Software After Design. Many developers of interactive videodisc programs assume that overlaying—the simultaneous display

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of video and computer information on one monitor—is always the best display method. The students chose hardware and software for its overlay capability, yet the final program included no overlaying at all. Instead, the display switched between video and computer-generated information, which was quite satisfactory for the content. This could have been done with a less expensive interface and simpler computer program.

What Should Be Taught in Interactive Video Courses?

As emphasized by Allen and Erickson (1986), there is growing need for interactive video designers. Their training in graduate programs should include real production experience.

The students in this course participated in a development project, as did those in Allen and Erickson's course, and had backgrounds similar to Allen and Erickson's students. Based upon this experience, it is suggested that learning to produce an interactive videodisc may not be best accomplished in a *first course* on interactive video or as a course project at all.

This project required two semesters, stretching the flexibility of university and student schedules. Allen and Erickson solved this problem by doing a shorter project, by using DRAW discs and not requiring check discs, and by shooting all sequences in a single day. Although their model for teaching interactive video production has advantages, so does a model in which students produce a 30-minute disc including check discs and standard mastering. The benefits include transfer to real-world projects and the usefulness of the discs produced.

The interactive video course has been taught twice in subsequent semesters. Students taking the course now learn interactive video concepts, programming, and design skills by repurposing existing videodiscs. Some of these students have subsequently gone on to obtain actual production experience on real projects within the university where staff with production experience manage the project and the students are apprentices.

Students *can* produce interactive videodiscs with very modest facilities and funds, thereby obtaining skills urgently needed in the commercial sector. Business, industry, and government agencies utilizing interactive video should seek to support universities in providing this training.

Although it may not be best for students' first interactive video course to include full-scale videodisc production, they should receive that experience during their graduate programs, possibly under an apprenticeship model.

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