

# Developing Interactive Videotape in a University Setting

---

Michael Palmer  
Mariela Tovar

---

**Abstract:** This article describes the work of an interactive video development group in the Graduate Programme in Educational Technology at Concordia University. It discusses the design and development of an interactive videotape system which will be used to teach contamination assessment and decontamination of radioisotopes to biochemistry students. The paper concludes with a discussion of relevant issues concerning the development of interactive video in an academic setting.

---

As part of their curriculum, undergraduate students studying biochemistry at Concordia University often carry out laboratory experiments involving the use of radioactive isotopes. The risk of radioactive body contamination and the potential for damage to the sensitive equipment used for detecting radioactivity are important concerns to the teaching staff of these students.

Traditionally, a series of manuals, slide-tape presentations and in-class demonstrations have been used to train students in correct laboratory procedures. Upon evaluating the effects of these instructional strategies, technicians in both the Chemistry and Biology Departments were not entirely satisfied with the results of the training. In a continuing attempt to improve instruction and training within the faculty of biochemistry, training needs were identified and potential solutions were identified through a series of discussions. As a result of these discussions, an interactive videotape training

---

**Michael Palmer** is an M.A. candidate in Educational Technology at Concordia University. His research interests are in the area of interactive video, instructional design and evaluation. **Mariela Tovar** is an Adjunct Assistant Professor of Educational Technology and Research and Project Development Coordinator at Concordia University, 1455 de Maisonneuve Blvd. W., Montreal H3G 1M8. Her research and teaching interests include computer applications in education, instructional design, and evaluation. This project was supported by a grant from the Committee for Aid to Scholarly Activity (CASA). Senior authorship is shared, names are alphabetical. The authors extend their special thanks to Gilles Doiron, Magda Hechem, Ken Todd, Chris Boer, Miriam Posner and Paul Taslini for their help with this project. We also would like to express our gratitude to Dr. Gary Boyd and the Audiovisual Department at Concordia University for sharing their resources with us.

---

program was produced through the cooperative efforts of Concordia's Chemistry, Biology and Education Departments. The program teaches the correct procedures for carrying out contamination assessment and decontamination of radioisotopes. The courseware was developed by a team which included faculty and students from the Graduate Programme in Educational Technology. The purpose of this paper is to describe the development of the training system and to reflect upon what we have learned while carrying out this project in our academic setting. We believe that the challenges that we faced — working under time and monetary constraints — are common in many settings and that our experiences will be useful for developers working under similar conditions.

Gayeski and Williams (1983) define an interactive video system as "microprocessor control of a video playback device (either videotape or videodisc), which allows individuals to view one program in different ways according to their response" (p.54). Floyd (1982) proposes a more general definition: "Any video program in which the sequence and selection of messages are determined by the user's response to the material" (p.2). A more recent definition by Schwier (1987) adds several elements that are missing from previous definitions: "Interactive video is a program intentionally designed in segments, in which viewer responses to structured opportunities (menus, questions, timed responses) influence the sequence, size and shape of the program" (p. 36). Interactive video is the combination of computer-assisted learning and linear video. It can offer the computer capabilities of interactivity and learner control as well as the visual expository qualities of video.

The merging of these two technologies has brought together computer and video specialists and they tend to see interactive video from their own particular perspectives. Video specialists see interactive video as a way of giving the learner more control over linear video, while computer specialists see it as a way of providing the computer with powerful visual capabilities. Interactive video, however, is more than video plus CAL or CAL plus video. It is a unique medium which presents designers with new possibilities of optimizing learning outcomes (Gayeski & Williams, 1985; De Blois, 1982).

The instructional potential of interactive video has been enthusiastically endorsed (Butcher, 1986; Clark, 1984; Howe, 1985; Manning, Ebner, Brooks & Balson, 1983; Pawley, 1983; Wilson, 1983). This is due to the fact that this technology opens up a number of instructional possibilities which were not previously feasible. The medium can integrate many different media, such as video, slides and computer graphics, as well as provide a wide range of feedback options and maintain a record of students' responses and choices. Furthermore, the rapid access and storage capabilities of the videodisc give designers the possibility of exploring different levels of learner control.

In spite of the potentials of interactive video, there have been problems associated with its implementation. One of the major drawbacks has been the perceived cost of the hardware and the larger variety of human resources necessary for development. Another problem, closer to the concern of educational technologists, is that little is known about design and evaluation strategies for producing interactive video materials. If interactive video is indeed a unique medium, then instructional designers, and linear video and computer-assisted learning specialists will be required to think in new ways.

### *Background*

Academic programs in educational technology are ideally suited to experiment with instructional innovations which offer the potential for optimizing learning. Faculty in the Graduate Programme in Educational Technology at Concordia University perceived a need to provide interested students with the opportunity to carry out development and research projects dealing with interactive video. We wanted to gain experience with this technology by getting involved in all the phases of design, production and development. It was thought that beginning with a practical development project that involved selecting appropriate design strategies and formulating evaluation questions would eventually lead to interesting research hypotheses. An interactive video interest group was formed in October of 1985 to serve as a forum for exchanging information, as a mechanism for establishing links with other groups interested in interactive video and for requesting support for development projects.

It was because of this group that we became aware of the need to develop new materials to teach undergraduate biochemistry students the procedures of radioisotope assesment and decontamination. After discussions were held with the appropriate parties, we submitted a proposal to replace their existing training materials with an interactive video system. The impetus for proposing interactive video courseware was the tremendous potential of the medium to teach procedures. Applying contamination assesment and decontamination procedures involves carrying out a number of steps in a sequential order. Using interactive video, the procedures could be presented using a series of demonstration, review, practice and test segments. Furthermore, the ability of the system to provide remediation, visual demonstration and feedback would facilitate the retention and transfer of learned procedures from the classroom to the laboratory.

The development team, consisting of four graduate students and one faculty member, was assembled in January of 1986. There were two video specialists, one software development specialist and the present authors who served as project manager and design and production coordinator. The financial resources were obtained from the Committee for Aid to Scholarly Activity in the form of a \$2500 grant. The following section describes the content and structure of the courseware.

### *Courseware Content and Structure*

The overall objective of the courseware is to teach radiation contamination assessment and decontamination procedures to biochemistry students who experiment with radioisotopes. Within the courseware, six separate sections are offered to the learner (see Figure 1 on page 199). The first two sections are purely informational. They can be accessed in order to obtain supplemental information pertaining to radioisotopes in general (i.e., Introduction) or to obtain information pertaining to a specific isotope (i.e., Isotope Information). The remaining four sections are instructional lessons which offer information describing the equipment and the steps that must be followed in order to carry out specific procedures and exercises which provide practice and feedback. Each of the sections is accessible from the main menu and they may be viewed in any sequence. What follows is a brief description of each section.

- 1) *Introduction:* The introduction section consists of a brief video presentation

- which describes the characteristics of radioisotopes and how they are caused. This section was designed in order to refresh entry level knowledge and skills.
- 2) **Isotope Information:** This section consists of a short data base which presents textual information pertaining to radioisotopes which are commonly used for experimentation at Concordia University. The information presented is technical in nature and serves as an option for the learner to obtain background information related to the radioisotope with which they are working.
  - 3) **Direct Check Method:** This instructional section describes the proper tools and illustrates the correct procedures necessary to carry out contamination assesment of high energy radioisotopes.
  - 4) **Swipe Check Method:** This instructional section describes the proper tools and illustrates the correct procedures necessary to carry out contamination assesment of low energy radioisotopes.
  - 5) **Decontamination Procedures:** This instructional section describes the proper tools and illustrates the correct procedures necessary to carry out decontamination of areas where the presence of radioisotopes has been detected.
  - 6) **Body Decontamination Procedures:** This instructional section describes the proper tools and illustrates the correct procedures necessary to carry out decontamination of clothing and skin surfaces in the event of a spill of radio isotopes.

### ***Instructional Section Structure***

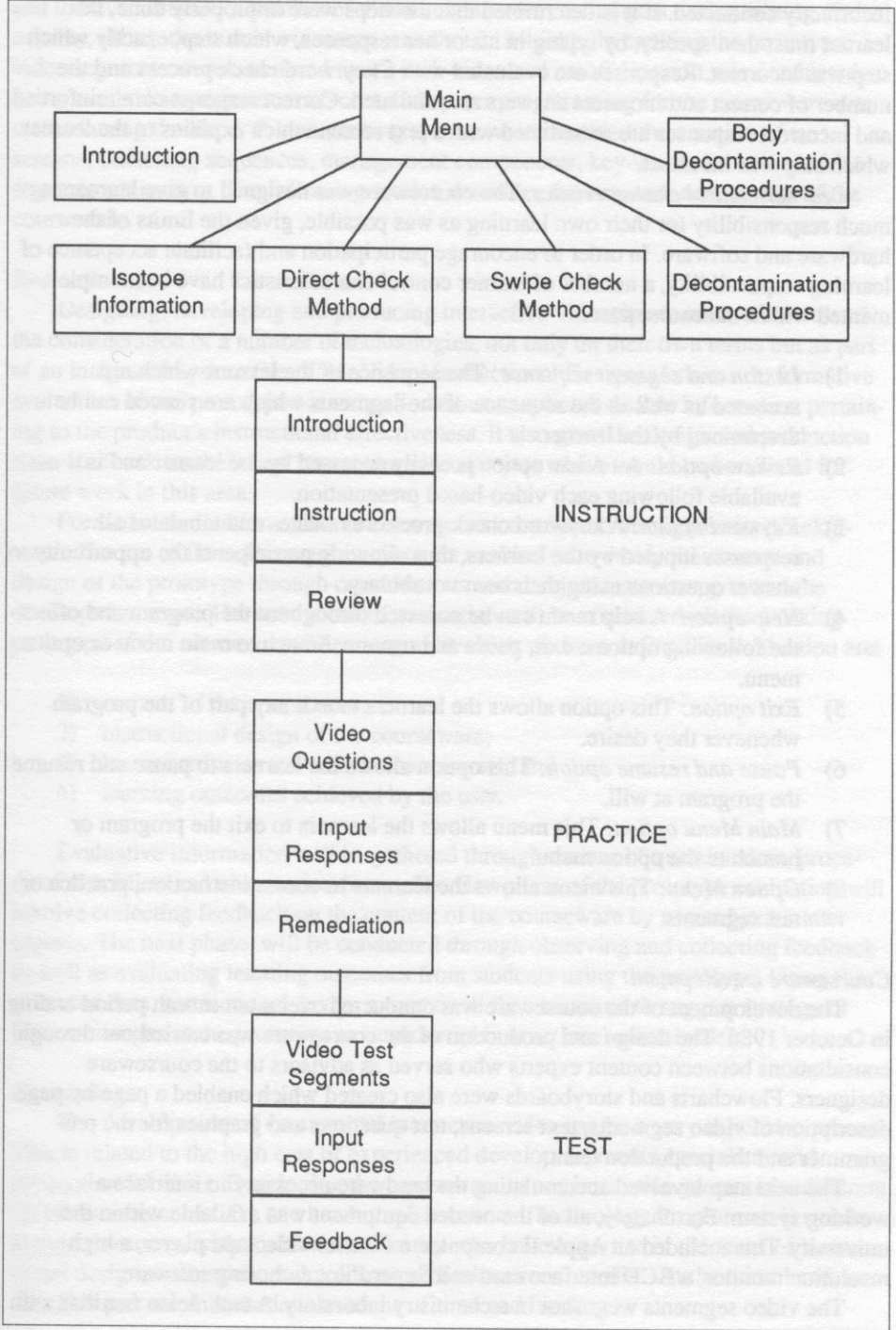
Each instructional section consists of three segments which are accessed from the *option menu* presented at the beginning of each lesson. The three segments are entitled 1) *Instruction*, 2) *Practice*, and 3) *Test* and can be viewed randomly, or in sequence, depending upon the learner's choice. A brief explanation of each segment follows.

**Instruction.** The instructional segments consist of a four to seven minute video presentation which includes a brief introduction to the procedure and a description specifying the situations which demand its application (Advanced Organizer). This is followed by an explanation of the tools and a demonstration of the steps which are to be carried out when applying the procedures. The segment concludes with a brief review which emphasizes the important steps to be remembered.

**Practice.** The practice segment consists of four video-based questions which pertain to the lesson procedures. Through questioning, the learner is prompted by the demonstrator to specify, in sequence, the procedures which were demonstrated in the instruction segment. The learner is asked to answer each question by typing in his/her responses following each question. Responses entered by the learner are evaluated with a key word check process which allows learners to respond to questions using their own vocabulary. At the end of the segment, correct and incorrect responses are automatically tabulated. In the situation where the learner incorrectly answers any of the questions, he or she is advised of this and is then branched to a video based remedial segment which again explains and demonstrates the procedures.

**Test.** The test segments consist of between four and six video based-demonstrations of the lesson procedure being carried out. The task of the learner is to view the

Figure 1. Courseware Structure.



demonstration and determine whether the steps of the procedure were correctly or incorrectly conducted. If it is determined that the steps were improperly done, the learner must then specify, by typing in his or her responses, which step, exactly which step was incorrect. Responses are evaluated with a key word check process and the number of correct and incorrect answers are tabulated. Correct responses are reinforced and incorrect responses are remediated with a text screen which explains to the learner which step was incorrect.

**Learner control characteristics.** The courseware was designed to give learners as much responsibility for their own learning as was possible, given the limits of the hardware and software. In order to encourage participation and facilitate acceptance of learning responsibility, a number of learner control characteristics have been implemented within the courseware.

- 1) **Lesson and segment sequence:** The sequence of the lessons which are accessed as well as the sequence of the segments which are viewed can be determined by the learner.
- 2) **Review option:** A review option is easily accessed by the learner and is available following each video-based presentation.
- 3) **Keyword option:** A keyword check process evaluates and tabulates all responses inputted by the learners, thus allowing participants the opportunity to answer questions using their own vocabulary.
- 4) **Help option:** A help menu can be accessed throughout the program and offers the following options: exit, pause and resume, branch to main menu or option menu.
- 5) **Exit option:** This option allows the learners to exit any part of the program whenever they desire.
- 6) **Pause and resume option:** This option allows the learners to pause and resume the program at will.
- 7) **Main Menu option:** This menu allows the learners to exit the program or branch to the option menu.
- 8) **Option Menu:** This menu allows the learners to access instruction, practice or test segments.

### **Courseware Development**

The development of the courseware was conducted over a ten-month period ending in October 1986. The design and production of the courseware was carried out through consultations between content experts who served as advisors to the courseware designers. Flowcharts and storyboards were also created which enabled a page by page description of video segments, text screens, test questions and graphics for the programmer and the production team.

The next step involved accumulating the hardware necessary to interface a working system. Fortunately, all of the needed equipment was available within the university. This included an Apple II computer, a Pioneer videotape player, a high resolution monitor, a BCD interface card and Super Pilot authoring software.

The video segments were shot in a chemistry laboratory. A technician familiar with

the procedures was used as our demonstrator. In order to obtain a good quality video and to have access to a number of video enhancement techniques during editing (fades, overlay, titles), the master videotape was shot in 3/4 inch. In creating the prototype, video segments were transferred to 1/2 inch video and an off-line edit was conducted using available equipment at no cost. Computer programming for the courseware was created using the Super Pilot authoring system which enabled the creation of text screens, branching sequences, management components, key-word checks and video segment addressing. The following section describes the structure and content of the courseware.

### ***Evaluation***

Designing, developing and producing interactive videotape courseware involved the consideration of a number of technologies, not only on their own terms but as part of an integrated system (i.e., CAI, Video, Instructional Design). As a result, formative evaluation of our prototype not only allowed us to solicit valuable information pertaining to the product's instructional effectiveness, it also gave the design and production team feedback on their first interactive video project which would be beneficial for future work in this area.

Formative evaluation of the courseware was conducted throughout its development. The use of flowcharts and storyboards enabled us to verify the content and design of the prototype through consultations with subject matter experts and the development team. The next phase of evaluation will be conducted on the working prototype of the courseware. The categories which we have defined for evaluation are:

- 1) content of the courseware;
- 2) instructional design of the courseware;
- 3) learner attitudes towards the courseware; and
- 4) learning outcomes achieved by the user.

Evaluative information will be gathered through the use of questionnaires, procedural checklists and observation forms. The first phase of the prototype evaluation will involve collecting feedback on the content of the courseware by two subject matter experts. The next phase, will be conducted through observing and collecting feedback as well as evaluating learning outcomes from students using the prototype. Using the collected data, instructional design experts will then be asked to suggest strategy or format changes to the prototype to improve its instructional effectiveness.

### ***Conclusion***

The development of commercial interactive video can be a very expensive process. This is related to the high cost of experienced developers, media specialists, and production facilities. Developing the courseware in our institution presented a different set of circumstances. On one hand, the Educational Technology Programme is rich in human resources, with students and faculty who have expertise in the areas of instructional design, evaluation, and production of educational media. On the other hand, our situation presented limitations in terms of time and funding.

Regarding our time limitation, it was important to consider that the individuals involved could not afford to give the project exclusive dedication. Team members could not ignore their professional and other academic commitments. This situation is quite different from the work environments described by Bork (1985), where development team members give a substantial part of their time to develop projects. In order to facilitate involvement, internship credits were allocated to students who participated in the project. This allowed individuals to integrate this activity with their academic requirements.

Regarding our funding limitations, our experience shows that it is possible to produce useful interactive video courseware without an enormous budget. Unfortunately, some of the literature on interactive video suggest that unless you have access to great sums of money, and can incorporate all the 'bells and whistles' available into your system, you should forget about it. We believe that this type of thinking produces two basic problems.

- 1) You spend all your time dreaming about fancy gadgets and overlook the possibility of simpler solutions to your instructional problem. We do not deny that some instructional situations could require costly systems and that their production represents a great contribution to our field. However, based on our experience, we would like to address the concerns of people who have been scared away from the technology because of this limiting assumption. Consideration of the problem from an instructional point of view rather than merely from a hardware perspective may indicate that, for a given situation, the problem can be solved with interactive videotape or even with video and a workbook. Cost effective solutions have been reported in the literature. They include modifications of existing materials (Laurillard, 1984; Branch, Robertson, & Moore, 1987) and production of 'generic' discs that could be customized by users. The conclusion is simple: if we carefully consider the instructional requirements of a given problem, *more is not necessarily better*.
- 2) A second problem involves forgetting that, although hardware facilitates interactivity, it is ultimately the design of the program which determines it. Interactive video can be seen as a very flexible medium which has the potential of being highly interactive. Unfortunately, too much emphasis has been given to the hardware without realizing that ultimately it is the pedagogical design of the program which determines interactivity. The most commonly cited taxonomy of interactive video systems classifies them in terms of hardware. The levels of interactivity proposed vary from level one (linear presentations with traditional playback mechanisms), to level two (videodisc with response device) to level three (systems with a videodisc linked to an external computer). A more useful classification of interactive video has been proposed by Gayeski and Williams (1985). These authors offer seven levels of interactivity which integrate program design and hardware considerations. With its emphasis on program design in addition to hardware aspects, this taxonomy is clearly more appropriate for instructional designers. It is not limited to videodisc, and provides a wider range of options for interactivity



from more traditional methods (self-evaluation, pause, use of workbooks) to sophisticated systems with touch screens and computer control. Consequently, this taxonomy opens up more possibilities for selecting an appropriate level of interactivity for a given instructional problem.

The production of radioisotope courseware provided us with valuable insights into designing interactive video materials. Given our resources, we found that the production of an interactive videotape was a feasible initial solution. The videotape was structured while keeping in mind one of its most critical limitations, namely access time. In an attempt to minimize the effects of this limitation, steps were taken to reduce as much as possible the time needed to rewind or fast forward to a particular segment. This included editing instructional sections and segments according to expected student choices and sequences. All of the video segments which were designed to branch with one another were closely edited together thereby minimizing access to four or five seconds. Computer generated messages were also built into the courseware and these appear while a search is being conducted.

A further advantage to our courseware will be our ability to obtain formative data and carry out modifications at a minimum cost. The value of interactive videotape as an inexpensive training tool and prototype for formative evaluation has been suggested in the literature (Cambre, 1984; Gayeski & Williams, 1986).

The development of the interactive video system provided us with a valuable learning experience. It allowed us to bring together people with different expertise in a team setting. Although all team members had backgrounds in instructional design and production, none had actually participated in the development of interactive video courseware. As instructional designers, we had to become familiar with the problems of integrating video and interactivity into the design. The design requirements of interactive video required production and editing techniques that were different from those appropriate for linear video. In collaboration with our computer specialists, we became familiar with the flowcharting and storyboarding techniques appropriate for interactive video. Furthermore, the evaluation will provide us with some interesting insights into our selection of instructional strategies and learner control options.

The experience we acquired in developing the interactive video addressed in this paper, along with the evolution of our design and production team into a cohesive unit, will hopefully serve as a basis from which we may proceed to undertake further projects in this area, including work based in videodisc technology.

## REFERENCES

- Branch, B.T., Robertson, B.L., & Moore, L. (1987, January). Producing a simple interactive videodisc. *E-ITV*, 20-21.
- Bork, A. (1987). *Learning with Personal Computers*. New York, NY: Harper & Row.
- Butcher, P. G. (1986). Computing aspects of interactive video. *Computing Education*, 1, 1-10.

- Clark, R. E. (1984). Research on students thought processes during computer-based instruction. *Journal of Instructional Development*, 3, 2-5.
- Floyd, S., Floyd, B. et al. (1982). *Handbook of interactive video*. White Plains, NY: Knowlton Industries.
- Gayeski, D. M., & Williams, D. V. (1983, August). Interactive videotape: Substitute, prototype or paradigm? *International Television*, 54-56.
- Gayeski, D. M., & Williams, D. V. (1986). *Interactive Media*. Englewood Cliffs, NJ: Prentice Hall.
- DeBlois, M. L. (1982). Principles for designing interactive videodisc instruction. In M. L. DeBlois (Ed.), *Videodisc/microcomputer courseware design*. Englewood Cliffs, NJ: Educational Technology.
- Howe, S. (1985). Interactive video: Salt and pepper technology, *Media and Methods*, 1, 8-14.
- Laurillard, D. M. (1984). Interactive video and the control of learning. *Educational Technology*, 6, 7-15.
- Manning, D. T., Ebner, D. G., Brooks, F. B., & Balson, P. (1983). Interactive Videodisc: A review of the field. *Viewpoints in Teaching and Learning*, 59, 28-37.
- Pawley, R. (1983). It's becoming an interactive world. *Educational and Industrial Television*, 66, 80-81.
- Schwieb, R. A. (1987). *Interactive video*. Englewood Cliffs, NJ: Educational Technology.
- Wilson, R. L. (1983). Interactive video: What makes it work? *Performance and Instruction*, 11, 42-48.