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INTERACTIVE MULTIMEDIA INSTRUCTION
FOR TEACHING WESTERN ANIMATION

DISSERTATION

Presented in Partial Fulfillment of the Requirements for
the Degree Doctor of Philosophy in the Graduate
School of The Ohio State University

By
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The Ohio State University
1997

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ABSTRACT

The interactive multimedia animation instruction design was created to teach undergraduate students about Western Animation. The final output of the design is an instructional CD-ROM designed especially for self-study teaching and learning activities. The CD-ROM imparts the essential aspects of the history, techniques, pioneers, and principles of animation.

Since the end of the major traditional animation production era in the late 1950s, people have associated animation with entertainment for children only. This confusion is the result of a lack of understanding of the contributions that past and present animators have made to society and the fine art world. The instructional CD-ROM was created to reveal and examine the important work of various types of Western animations from the beginning of the eighteenth century to the present.

Multimedia technology gives art educators and students new opportunities in teaching and learning activities that may not be experienced by traditional teaching methods. With this technology, an art instructor has the opportunity to design a specific type of multimedia teaching system by using computers and authoring software. Because the result can be put in a CD-ROM, it is very practical for the both art instructors and students to carry the teaching design to any CD-ROM facility and use it whenever it is
necessary. The teaching and learning activities do not always have to be arranged in the classroom anymore. The CD-ROM technology allows the students to have more freedom to choose the time and place to learn.

Interactivity is one of the main keys to create successful teaching and learning activities. Because it can be used without the necessary presence of an instructor, it is important that the CD-ROM be designed to interact with the user the way an instructor does in the classroom. Without interactivity, it is much more difficult to engage learning activities. This means the CD not only imparts information but also must encourage the user to explore the theoretical and practical aspects of Western animation inside and outside of the CD, build a knowledge and understanding, and appreciation of the work of Western animation, and should be able to improve his or her animation skills at the end.

The interactive multimedia CD-ROM was not created to replace a classroom instructor. Based on my experience in working with computer technology and teaching art education courses, I believe that there is no technology or machine that can substitute for an instructor in the classroom. The CD was designed to offer both art instructors and students new opportunities and freedom in teaching and learning.
Dedicated to my parents and husband
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CHAPTER 1

INTRODUCTION

This research project concerns the design and implementation of an Interactive Multimedia Instruction (IMI) Compact Disc-Read Only Memory (CD-ROM) that can be used by undergraduate students to learn about the history, pioneers, techniques, and principles of Western animation.

The focus of the research is on the development of the IMI program and the examination of the process of using the IMI. In this research, I did not examine the students' knowledge improvement in using the IMI CD-ROM nor how much students learned before and after they used the IMI CD-ROM. I did examine the function of the navigation system, the presentation of the teaching materials, the amount of data available in each teaching section, the clarity of quizzes, and the accessibility of all information in the IMI CD-ROM.

A case study research methodology was utilized because with this


2 A read only memory device is one from which a user can access and read or copy information, but from which one cannot add to, edit, or delete.
methodology, I could carefully examine students' activities in learning with
the IMI. The examination was based on the students' learning environment
and facilities, interviews, qualitative analysis, and narrative reports.

One of the core problems in the field of art education is to design an
effective teaching system for a given set of circumstances. Since the early
history of education, teachers have tried to develop and expand their teaching
methods, curricula, and syllabi to achieve better results. Nevertheless, no
absolute or definitive teaching method has been invented. One of the
reasons why there is no exact teaching formula is because the social system is
always changing and developing; because of these changes, society invents
new ways of living, new culture, and new technology that also alter legal,
political, economic, and educational systems. In short, as long as a society
exists, it will always need a developing educational methodology. With this
in mind, I examined the possibility of using interactive multimedia
technologies for teaching Western animation.

The reason for choosing animation as the teaching topic is its
increasing role in the field of education. Animation started as entertainment
productions in the early 1900s; but its use has since been expanded to include
educational purposes in many disciplines of study including science,
engineering, music, art, business, sports, and literature. One of the most
significant contributions to the increasing role of animation is the
development of computer-graphics technology. The use of computer
technology in animation has revolutionized the appearance of animation, as
it not only provides fascinating visual effects but also a practical and
comparatively rapid animation production system.

In accordance with the increasing role of animation in society,
educators and intellectuals have started to observe the animation field more seriously. Many art colleges now offer comprehensive traditional and computer animation courses, which include philosophies, critique, technique, and history of animation. Besides educational systems, commercial CD-ROM production companies have also produced various animation film selections that range from classical and contemporary commercial to educational animation films. Now CD-ROM technologies also are used to impart information about animation through the use of a unique teaching approach that was not familiar before the computer era: interactive multimedia-based teaching.

Multimedia-based systems allow the computer operator to interact with the program to learn or understand a topic, without the presence of an instructor. The operator can not only see visuals of the process being studied, but also can hear sounds from the program. Basically, the use of interactive teaching media works in the same way as any other teaching method: through emphasizing the importance of communication between the student and the teacher. Without good communication between the two parties, interactive technology decreases in usefulness.

In Interactive Multimedia, Ambron (1988) explained that the role of multimedia technology in education is becoming increasingly important because it holds great promise for improving the quality of education. She contended that children who are used to watching television, listening to music, and playing computer games find multimedia a more compelling learning tool than the book-and-chalkboard educational media of their parents' generation. Multimedia technology offers teachers and students new experiences in learning and understanding.
Today, one can find CD-ROMs devoted to many interests, sources of information, and disciplines. It is not difficult to find CD-ROMs about art, music, mathematics, physics, sports, and animals, and yet, there is still no interactive multimedia program for learning the Western animation. I believe that to examine the significance of animation thoroughly, I also have to investigate how it functions in society. Without examining this aspect of the subject, many prestigious and useful achievements of animation pioneers may be abandoned and forgotten.

Because a multimedia-based system can be arranged without the presence of an instructor, it needs to use other strategies to provide explanations as clearly as possible. In general, CD-ROMs use verbal and visual language to deliver teaching material to the user. Examples of visual language are color, texture, and layout compositions, animation clips and still images presentation. Use of a multimedia system can encourage the user to be independent and creative in following the commands or steps in the system to achieve particular levels of understanding.

An interactive multimedia program concerned with animation would offer the field of art education an opportunity to communicate complex visual information to students. It would be a model for the use of multimedia in other areas of art education.

Statement of the Problem

Because there is no absolute rule in designing an interactive animation teaching program, my structure for the statement of problem is based on my experience in teaching animation courses. In my opinion, the major questions involved in creating the teaching program are: (a) How can I
construct an interactive multimedia CD-ROM that will teach the Western animation for undergraduate students? What outcomes should be expected from the students' interaction with this system?; (b) What feedback do I need from the research participants to improve the creation of the IMI CD-ROM? How can I achieve the feedback and how should I process it in my research?

These questions have to be examined from the viewpoints of both instructor and students. In this case, the instructor is represented by the multimedia authoring system, and the students are seen as the users. The instructor manipulates text, graphics, audio, and animation to impart information. The students can gain knowledge only if they react or communicate with the information. Communication failure is fatal for the interactive teaching and learning process. Thus, it is important for the multimedia instructor or designer to know the art of authoring.

In *Amiga World*, Louis R. Wallace (1991) asserted:

If you were to give 50 different programmers the same programming assignment but left the implementation of the program up to them, chances are very good that you would end up with 50 different approaches to solving the same problem. (p. 23)

This situation is the same for finding the best authoring method. It is more an intuitive art than an exact science. Although creating an authoring system is not a science, there are specific steps involved in the creation of the system. For example, to begin a programming task, it has to be clear what it is the author intends to create. The author needs to thoroughly

---

3 Authoring method in this case means the method of creating a software that allows the user to produce interactive multimedia instruction design. Examples of an authoring tool are Multimedia Director, Authorware, SuperCard, and HyperCard.
and completely define what the program will do. The problem specifications determine how good, fast, and useful the design will be.

Review of Related Literature

The purpose of this literature review is to investigate (1) the use of interactive multimedia technology in the discipline of art education and (2) the historical, theoretical, and practical aspects of Western animation. Based on this investigation, I determined the context, content, and teaching method for a teaching program concerned with Western Animation.

I have examined the interactive multimedia technology in education in three subjects areas:

(1) the application of computer technology in art education
(2) the production process of IMI
(3) the role of evaluation in multimedia design

I have examined the field of animation and divided it into four subjects:

(1) history of animation
(2) pioneers of animation
(3) techniques of animation
(4) principles of animation

I also examined literature about the learning process with modern telecommunication media such as television and computers. These media were chosen because they were popular media and play important roles in providing information in modern society. Literature on this subject includes from Mind and Media by Greenfield (1984) because Greenfield explained the comparison between learning from literature, radio, television, and computer. This information is necessary as a starting point to do my research
because, such as radio, books, and television, the IMI CD-ROM provided literature, music, sound, and visual information. In *Mind and Media*, Greenfield explained the use of modern media in children's daily lives and how each medium influences children's ways of thinking and learning processes differently; how effective a teaching system can be; and how to use each media wisely to be able to develop children's learning ability.

The literature resources for IMI include *Interactive Multimedia* edited by Ambron and Hooper (1988), *Artificial Intelligence and Education Volume One* edited by Lawler and Yazdani (1987), *Interactive Multimedia Instruction* by Schwier and Misanchuk (1993), and *Computer Graphics: A Survey of Current Techniques and Applications* by Lewell (1985). *Interactive Multimedia* contained explanations about the use of the technology in the future development of the American education system by using powerful computer, high-speed telecommunications, and optical storage devices such as CD-ROM and videodisc. *Interactive Multimedia Instruction* is a thorough guide through the basic to advanced steps for creating an interactive tutorial program. Lewell's book provided a general explanation about the role of computer technology in commercial, industrial, and educational areas.

Crafton explained the history and development of animation technology before the Disney era. Russett examined the history of experimental animation. Lewell's book explains a survey of computer-graphics techniques and applications in different fields such as industry, business, illustration, and medicine.

**Purpose of Study**

The purpose of this research is to create a CD-ROM that supports an IMI through which students can acquire knowledge about many aspects of animation. These include the history, pioneers, social function, and technological development of animation. The information media of the CD-ROM are images, film clips, animation, sound, words, numbers, and text.

CD-ROM-based programs can be more comprehensive than traditional learning programs because the learner can interact with audiovisual representations without requiring white/blackboard, chalk, tape recorder, slides, VCR, and television. Greenfield (1984) explained the difference between learning from TV programs and learning from texts.

Greenfield (1984) stated:

> Print in itself is merely a medium for transferring information; it is not a whole set of higher-level thinking skills. Print is probably a less efficient way to convey information, overall, than is television, with its dynamic visual images, which are more easily understood and remembered than are words. (p. 93)

Greenfield explained that by interacting, seeing, and listening at the same time, students were able to learn more easily than by only reading a textbook. Based on my opinion, a combination of literature and visual explanation could be used as an effective teaching method to impart...
information. For instance, I needed to explain the difference between animated films before and after Disney created "Steamboat Willy" in 1928. I gave reading assignments to the students about related issues. The students then read the assignments and wrote reading evaluation papers. In the classroom, I evaluated the reading assignments and presented the related animated films. After discussing and evaluating the films, the students would understand the subject matter better because they saw examples of what they read in reading assignments. Without seeing the visual examples and without interactive discussion, it would be hard for the students to have an accurate explanation of the teaching material. I do not feel that literature is less important than visual and sound information or vice versa; I needed to use all of them to be able to teach effectively. Interactive media, such as the IMI CD-ROM, provide literature, visual, and sound all together. These media may be useful to help students who have difficulty in learning from a printed text or from an instructor. According to Ambron (1988):

[A] videodisc of milestones in human development would be a useful research and learning aid for students, because the subject matter of early human development is so rich visually - and is difficult to communicate with traditional text and still-image forms alone. (p. 7)

In spite of the many advantages in using a CD-ROM, this research does not intend to put aside other animation teaching methods or media. Instead, this research investigates the enriched capability for imparting knowledge to people who are interested in understanding animation. There is no perfect teaching method. Each one has strengths and weaknesses. For example, reading is a mental and visual process through which text is translated into ideas, pictures, and sound in the mind of the reader. It is a process the success
of which depends upon the integration and experiences of the reader. A film, on the other hand, provides pictures and sounds for the learner. The viewer-listener is given a definite perspective, picture, and tone, thus creating understanding for some that is clarifying and for others that is limiting. Some people can learn by viewing demonstrations and being able to ask questions of the demonstrators. Some subjects are best taught by hands-on experimentation by the learner.

**Design of the Study**

The research is especially designed for undergraduate students in the departments of art education, fine art, history of art, and industrial design. All of these departments are closely related to the field of art. The IMI CD-ROM was designed to give comprehensive information for students or to provide future animators with theoretical and philosophical knowledge to apply it to the production of animation. Those who are not art majors but wish to know some animation principles or history can use the IMI program for independent study.

The IMI was created by using the Macintosh authoring program Macromedia Director. This completed instructional program will be recorded as a CD-ROM. The reason for using Macintosh software and hardware is because these products are available on campus and are highly accessible in American educational systems and production companies.

The IMI will be organized as a medium that functions as an instructor or guide. It has to be intelligent enough to give information, and refine and create knowledge. It has to create questions, examine answers/questions, offer solutions, and impart some understanding. It has to encourage learners
to ask questions, explore, and experiment with the knowledge. The present problem is how to mix all these different types of information to be able to achieve this goal.

It is important to know that IMI does not function merely as a passive tool that provides information. It is designed to be an interactive partner with the user for learning animation. Weyer (1988) advised in *Interactive Multimedia* that:

> ... instead of regarding an intelligent system as a human replacement, we can consider the system as an adaptable tool, an intelligent medium, or a helpful assistant or partner. (p. 90)

What I did next was to divide the animation information that would be included in the program. I set up an outline to determine the most important information for learning the various aspects of animation. Without the aid of an outline, the information might be too broad or too shallow or not well-connected. Based on my decisions, the information of animation field was divided as follows:

I. History of Animation

A. Commercial Animation

1. Major Animation Productions

   a. Disney

      (1) 1928 - 1941
      (2) 1941 - 1945
      (3) 1945 - present
      (4) feature animations

   b. Warner Brothers

      (1) 1930 - 1940
      (2) 1940 - 1960
      (3) 1960 - present
c. Metro Goldwyn Mayer
   (1) 1930 - 1940
   (2) 1940 - 1960
d. Fleischer
e. United Productions of America

2. World War II Animation

3. Television Animation

B. Experimental Animation

1. European Experimental Animation
   a. Leopold Survage
   b. Walter Ruttmann
   c. Hans Richter
d. Oskar Fischinger
e. Len Lye
f. Berthold Bartosch

2. American Experimental Animation
   a. 1940 - 1960
      (1) Norman McLaren
      (2) Douglass Crockwell
      (3) Mary Ellen Bute
   b. 1960 - 1980
      (1) John Hubley
      (2) Jules Engel
      (3) Robert Breer
      (4) Jane Aaron
      (5) George Griffin
      (6) Kathy Rose
      (7) Suzan Pitt
      (8) Sally Cruikshank
      (9) Paul Gablicki

II. Pioneers of Animation

A. Winsor McCay
B. Emile Cohl
C. James Stuart Blackton
D. John Randolph Bray

III. Techniques of Animation

A. magic lantern
B. persistence of vision “toys” [as devices]
C. cel animation
D. clay animation
E. computer animation

IV. Principles of Animation:

A. squash and stretch
B. timing
C. follow-through
D. ease-in and ease-out
E. staging
F. anticipation

The “History,” “Pioneers,” and “Techniques of Animation” sections contain large amounts of text. To make the text interesting, it is presented with colorful layout, various types of textures, music, sounds, and short animations. Still images of cartoon characters, famous animators, and film clips are interspersed with the text. At the end of each reading section, the user can choose whether or not to take a quiz.

There are quizzes for the “History,” “Pioneers,” and “Techniques of Animation” sections. Each section offers three types of quizzes: matching, jigsaw puzzle, and multiple choice. The user will have a reward whenever he/she answers the question correctly. This reward can be an entertaining sound/music, cycle of colors, or praising sentence.

Each aspect of the “Principles of Animation” section contains a
paragraph of explanation and a 3-D animation. There is not much text in this section because the animation is more effective in providing comprehensive explanation than the text would be. For instance, to illustrate the “Ease-In and Ease-Out Principle,” I created a bouncing ball animation that squashes and stretches whenever it bounces on the floor.

“The History,” “Pioneer,” and “Techniques” sections provide the historical, philosophical, theoretical, and practical aspects of animation. “The Principles” section explains the process of creating animation and how to present a communicative visual expression in the animation world. It includes the concepts of motion, facial expressions, the law of gravity, the importance of surprise and climax, and the arrangement of lighting. All of these are important to present some message to the audience or to set up a certain mood to make the animation appear believable and convincing. Take, for example, the anticipation principle in animation. Anticipation is used to emphasize an action scene in which the climax is about to happen. Anticipation appears before a surprising, shocking, or hilarious climax. Body language, facial expressions, and sudden changes of background music or sounds can be used to show anticipation. The audience should feel this anticipation to know that some climax will happen soon.

To be able to show the divisions in IMI clearly, I have created a diagram that displays all branches and units of the program (see Figure 1.1).
Figure 1.1: branching system of the IMI

I collected the data from various types of media for the teaching materials or information about Western Animation in the IMI CD-ROM. The computer passes this information to the user through interactions with the CD-ROM. The user receives the information and reacts by clicking buttons or dragging images or letters to the correct position. This reaction triggers the computer to do certain activities, such as taking the user to the new pages, areas, chapters, or giving certain information. The action-and-reaction process can be seen as a continuous interactive method. Ambron (1988) created the diagram of Multimedia Elements to illustrate the learning
process with interactive media (see Figure 1.2). I modified her diagram to explain my interactive process methodology (see Figure 1.3). I added Output/Input and User categories, because I wanted to stress the importance of interactive processes between the user and products.

Figure 1.2: multimedia element

Based on this understanding, the first design principle is the accessibility in choosing certain information. This availability of information...
will give the user some control in going to the next sequence of instructional components.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure13.png}
\caption{interactive multimedia instruction}
\end{figure}

\((*) = \text{Output from computer to user and Input from user to computer.}\)

\((o) = \text{Input from user to computer and Output from computer to user.}\)
**Method of Data Analysis**

The primary purpose of the data analysis was to find out whether or not the IMI is a user-friendly instructional program that presents Western animation teaching materials clearly and excitingly. I would have assumed that the IMI program was a failure if the students did not think that the program helped them in learning Western animation easily or in interesting ways, if they were confused in using the IMI, or found out that most of the information was unclear or boring. If this situation occurred, I would have to find the difference between the result and expectation, what caused the difference, and what should be changed to accomplish the goals.

After examining several methods of analysis, I decided to use a case study method as explained in Jaeger's (1985) *Complementary Methods for Research in Education*. In Section V of Jaeger, Stake stated:

A case study that portrays an educational problem in all its personal and social complexity is a precious discovery. (p. 254)

By using this method, a case study can be examined in detail. This method is used because it provides a naturalistic approach to the problem. This approach is used to conduct a careful study of human activity in its natural and complex state. It does not merely take a generalization of a survey to establish a presumption. Instead, this method allows the researcher to understand each particular case, with its own character, totality, and boundary. The boundary means everything within the parameters of what I was studying. Stake explained that it is important to have a boundary system to have some conception of the unity or totality of a system with some kind of outlines or boundary (Stake, p. 255). The focus of the research is a single case of study, and not a whole population of cases. For instance, I had ten...
participants for my research. By using the case study, I did not generalize the teaching and learning process of all participants. Instead, I could examine each participant carefully based on his/her learning experience with the IMI.

Research data was gathered through (1) interviews with all users, (2) qualitative analysis of each case study, and (3) narrative reports. Based on these data, I created a conceptual structure, built up an understanding, and drew some conclusions. To be able to achieve greater validity of the case studies, the information was gathered using three different approaches: (1) direct observation, (2) interview, and (3) questionnaire. According to Stake (1985), an observer can use a triangulation technique, that is multiple approaches, to obtain a similar or more dependable result. This technique is useful for trying to arrive at the same meaning by at least three independent approaches.

The research was concentrated on the arrangement of the IMI program and the effectivity in imparting teaching materials. The role of users was very important to establish some standard or measurement in a teaching-learning situation. After deciding the research concept and the role of users, I needed to set up a bounded system to evaluate the research data. According to Stake, having a bounded system is important to have some conception of the unity or totality of a system with some kind of outlines or boundary (Stake, p. 255). The boundary system of my research is the presentation of the Western animation teaching materials of the IMI and the user's experience in learning with the IMI. This boundary is important to determine a pattern of behavior that explains the interaction process, the reason for doing similar/different action/reaction, and the principle of giving instructions. Although it is not possible to record the whole report of every detailed user's
experience in each case study, the research can have some unity of the cases, experiences, and conclusions.

The research observation was arranged for ten undergraduate students at The Ohio State University. Each student had one to two weeks to use the IMI program, and then I arranged an interview with the user. The users were also asked to fill out a questionnaire.

The relationship of the process of creating the IMI, design study, and research observation is illustrated in Figure 1.4.

![Figure 1.4: learning system and improvement process of the IMI](image)

**Expected Result**

1. **Accessibility**
   
   The computer enables students to explore and convey knowledge by exploring and learning from the IMI.

2. **Active learning environment**
Interactive multimedia-based teaching methods encourage students to be active and take initiative in building their own knowledge by interacting with the computer. The student decides what to learn, where to explore, and when to examine the teaching material.

3. Learning speed

Students can determine their own learning speed without affecting the classroom learning pace. Students can spend as much time as they want on finding multimedia information. As a result, some students may know more than others do about some material and an opportunity is created for peer teaching.

4. Multimedia information

Before the computer era, an instructor needed to have many instructional materials and devices (e.g., books, maps, projectors, tape players, etc.) in the classroom. A computer system reduces the necessity for so much equipment.

5. Appropriate teaching program

By using authoring software, an instructor can create a teaching program that is appropriate for the class material. The instructor can rearrange the program whenever it is needed. Adding or subtracting information or changing the format can be done quickly. This system gives teachers more choices for conducting the class. Teachers can design programs that are appropriate for the needs of their students.

6. Interaction

In computer-based teaching environments, students can interact not only with the computer, but share ideas with other users. Active students can have more information and feedback from both the computer and
instructor. With this method, every student is stimulated to be active and arrange interactions. Shy students are not as intimidated by computer learning as they are by traditional methods because nobody interferes in their interactions with the computer.

7. No generalization

With a computer-based teaching system, each student can decide what materials to learn and how long he/she needs to understand them. If it is still difficult to understand the material, the student can ask the instructor for help.

Significance of the Study

The study is significant because it contributes to the development of several different fields: art, art education, film history, and interactive multimedia technology. By using the IMI CD-ROM, art instructors will have a new teaching tool and students will have a different learning experience. For students who have difficulty in learning through traditional education methods, the use of the IMI CD-ROM offers them another way to learn. As long as they have CD-ROM reader facilities, students can learn about animation anytime and anywhere. They do not need to make an appointment with the instructor first or attend the class. They do not have to face an instructor directly, be afraid to make trials and errors, or fear facing critical judgments from the instructor or other students.

Through my research, I attempted to demonstrate the influential role of animation in society. This research indicates that animation is not merely entertainment because modern animation increasingly deals with the fields of education, business, medicine, sport, science, and technology. People who
are interested in having information about animation can obtain it not only from books, magazines, or movies but also from the CD-ROM that I have created on the subject.

As an artist who uses computer technology to create artwork, I believe that I should use the technology not only for my own artistic purpose, but also for the development of the technology itself. I have contributed to computer technology by exploring the potential of the computer and creating an interactive multimedia instructional program for teaching animation. It is to be hoped that my experiments, designs, observations, and trials of the research can stimulate input or feedback that is important for achieving further advances in interactive multimedia technology.
CHAPTER 2

LITERATURE REVIEW

I examined literature from the field of Art Education, that concerned interactive multimedia technology. I divided this literature into three categories: (1) the application of computer technology in Art Education, (2) the evaluation of the IMI, and (3) the teaching material of the IMI.

Application of Computer Technology in Art Education

The most obvious application of computer technology in the field of education is visualization. Visualization includes the creation, manipulation, analysis, and representation of images. The visualization is presented in the form of still images, animated films, layout, or interface design for presenting teaching materials. Visualization has a significant impact on the way art educators teach and discuss important concepts in the art disciplines.

Computer technology also plays an important role in designing IMI and offers a new teaching method for art instructors. I reviewed literature
that examined how art instructors adjust their teaching methods and expectations when they use this new teaching technology. Using Authoring in Education - Customizing Computer-Based Lessons for Students by Davis and Budoff (1986) and Preparing Instructional Text: Document Design Using Desktop Publishing by Misanchuk (1992) was used to discover the advantages and drawbacks of IMI and to compare it with traditional teaching methods. How IMI affects the instructor’s role in the classroom was also investigated. If it cannot replace instructor’s existence completely, how important is its role in contributing to the teaching and learning process in the classroom?

In Computers and the Learning Process in Higher Education, Kerr (1975) explains that computers are the only technology that can make a potentially significant contribution to instructional technology. Kerr’s examination is rightfully based on the current market of computer technology and its application to the field of art education. The three dominant software categories in the market are publishing tools, professional design, and data communication. The publishing tools relate to word processing and desktop publishing. The professional design deals with computer-graphics software for image processing, 2-D and 3-D computer-aided design, digital photography, and multimedia; the data communications relate with Internet and network communication.

The art education field uses all three computer categories. It is very common to use a word processor to write educational reports. Computer graphics courses in art education cannot be arranged without 2-D or 3-D computer-aided design software. Information about art or education can be easily accessed through the Internet or network system. With authoring
software, an art educator can design a special teaching program for specific information.

Despite these advantages, most art educators are still reluctant to embrace computer technology. In his article titled "The ant and the grasshopper: A program for adopting microcomputer graphics in the arts," Youngblood (1988) explains that this is because of (1) the speed with which the microcomputer revolution is occurring, (2) the disenfranchisement of educators in the development of the technology, (3) lack of appropriate software with which to work, and (4) because of the high costs of implementation (Youngblood, 1988).

With the application of the technology in the classroom, the teaching and learning activities are different from those of the traditional classroom. Art educators should arrange a specific curriculum to exploit the strength of the technology. Freedman (1991) wrote in her article, "Possibilities of Interactive Computer Graphics for Art Instruction: A Summary of Research," that to create an appropriate computer curriculum, an art educator should realize (1) the computer graphics production processes in general, (2) the social dynamic of computer graphics production in school, and (3) qualities of computer graphics imagery.

As in the art education field, computer-graphics applications can also be found in the fine arts. Although artists have utilized modern technology since the 1960s, the use of computer technology in art increased much more rapidly in the 1980s with the invention of user-friendly computer software and hardware. Lovejoy (1992) wrote a comprehensive explanation about art and technology in Postmodern Currents. In this book, she described the emergence of Postmodernism, its philosophical background, and its relation
to the application of modern technology in current art trends. She also compared the traditional and computer-based art media and how fine-art artists respond to this trend.

To organize the teaching material for the IMI CD-ROM, I used my own master's thesis titled *The Art Curriculum for Teaching the Social Aspects of Animation* (1994). In this thesis, I compared several different computer-graphics curricula from various colleges in the U.S. I also provided a historical explanation of major animation movements or studios from World War II to the 1990s. All historical explanation was related to the social conditions or interests of the time to explain the creation of certain animation styles or how the technological and social condition influenced the development of animation world.

Evaluation of the Interactive Multimedia Instruction


Tyler's model stresses measuring student progress by means of instructional objectives. Evaluation functions as the process of assessing the degree to which the program achieves its predetermined objectives. This model concentrates more on the objective character of its goals than the values of these objectives. Because of this, it is claimed that the data can be accurate, valid, and reliable for evaluation (Hudspeth, 1993). On the other hand, this type of evaluation does not examine the condition or process that
influences a student to make decisions or to provide answers. This means the evaluation model can only measure superficial revisions of performance objectives (Hudspeth, 1993).

Provus's 1969 decision-making approach combines the task of the evaluator and decision-maker. It is the evaluator's task to delineate information to be collected, plan a data-collection methodology, and help the decision-makers use the collected information. The decision-maker should make judgments based on the information collected by the evaluator. With this system, the task of evaluator and the decision-maker is clearly established. But it would not be easy to apply this model in an instructional design project conducted by an instructor who usually has to work as the programmer, evaluator, and decision-maker. How could the instructor divide the task clearly and objectively when there is no one else working with him/her?

Scriven's values-based approach to evaluation offers another possibility of forming an evaluation model. He believes that the distinction between the roles and goals of evaluation are often intentionally blurred. Whatever its role, the goals of evaluation are usually the same: to estimate the merit, worth, or value of the thing that is being evaluated. The blurry distinction between the role and goal of evaluation is usually the result of a misguided attempt to minimize the anxiety of the person being evaluated. This condition could increasingly lead to a distorted evaluation that may have no certain goal or is "goal-free" (Tucker, 1993). To prevent this, an evaluator should examine the goals of the educational program and judge the worth or value of these goals against some standard of merit. By examining collected data, the evaluator may find out whether or not these objectives are
met (Tucker, 1993). Scriven’s model emphasizes the function of the evaluator as the person who controls the goal of the project. My question concerning Scriven’s theory is how one can be sure that a goal-free evaluator examines the objectives of the project properly.

From the concepts of these three evaluation models, it is clear that education experts often try to find measurable data to judge the outcome of a project. Unfortunately, not all data can be measured accurately. If the evaluator depends only on the measurable data, he/she may not pay attention to the nature of the project. For instance, to evaluate the multimedia design to teach the social aspects of animation, an evaluator can count or measure accurately how many correct or incorrect feedback are produced. However, measuring these feedback without relating them to the goal of the project will not be enough as the instructor or programmer may fail to understand why the user fails to attain a certain knowledge level from the program. Examining personal objectives and relating them to the nature of the project may also explain how the instructor should design the program to guide the user to achieve the best result.

Personal objectives and the nature of the project may not be measurable because they include very broad areas. For example, to examine the user’s personal objectives, the instructor may need to know the motivation, interest, learning ability, and background of the user. These aspects may influence results of the learning process with the multimedia design. One cannot measure these aspects as accurately as counting feedback in the program. To solve this problem, the evaluator can also give questionnaires or even interview the student to judge how well the student interacts with the program.
One way to lessen the impact of inadequate data is to relate the project goal to increasing the user's ability. The issues of the user's skill and motivation have to be addressed at the beginning of the project, long before arranging the IMI. Once the users are determined, the instructor/programmer must design the IMI with this targeted group in mind.

Although not everyone has exactly the same knowledge background or problem-solving ability, the instructor should determine the standard ability and/or characteristics of the targeted consumer. According to Hudspeth (1993) from The University of Texas, the list of the characteristics might include:

- basic academic skills (reading comprehension, general reasoning ability, problem-solving skills)
- lesson-specific entry knowledge (vocabulary, symbols, recall of procedures, use of formulas and equations)
- ability to engage in instructional strategy (team skills, rote vs. didactic, prepare a specimen, matrix or graphic)
- processing mode (audio/visual/kinesthetic preference, ability to monitor self, holistic vs. serial thinking, procedural vs. exploration)
- motivation (internal vs. external, self-imposed vs. peer or teacher-imposed) (p. 297)

My concern about Hudspeth's theory is if these characteristics can really influence interaction processes, then how can the instructor measure them? In my opinion, the instructor should know the students' knowledge background before asking them to participate in the project. The important
qualifications, such as basic academic skills and lesson-specific entry knowledge, can be collected at the beginning of each lesson. Some users may learn as quickly from audio as from visual information; others may not. Some may learn well from nonlinear learning experiences; others may need greater structure. Each of these factors must be taken into account to create a learning system that acknowledges individual differences in learning.

**Arrangement of the Evaluation Model of the IMI**

Although there is no absolute "right" evaluation model for a certain project, there is no doubt that evaluation is important to determine if the project's goals have been met. In my opinion, evaluation also helps the instructor to:

- maintain relevancy between the project’s goal and user feedback
- obtain interactivity between the user and the instructor
- select reliable data
- draw conclusions from the project
- systematically use reliable data for thorough observation

To evaluate the design thoroughly, I needed to observe both quantitative and qualitative data sources that portrayed a more holistic reality. It is important to gather information in the right context. Just observing the number of correct or incorrect answers and feedback is not sufficient without finding out the user’s perceptions of the IMI. Therefore, interactive process data needed to be gathered not only from the user’s interaction with the program but also from questionnaires and interviews.

I realized that without having feedback from my research participants, it would be difficult for me to find out how effective the IMI is as a teaching
tool. The participants had to give me some feedback by explaining their experience about how much they learned after reading each teaching section or entire set of major sections in the IMI. I expected the participants to observe the accessibility of all teaching sections in the IMI.

The type of feedback requested depends on the design of instruction and the mode of delivery. The instructor can program a teaching design in response to interactive choices made by participants. Their choices will determine their understanding of the program. Some examples of possible feedback mechanisms are:

(a) For a correct answer, the program will give some additional points or a quickly played musical scale for the user. For each incorrect answer, the program reduces the user's points and provides information related to the question. Here, the music and scoring system provide feedback.

(b) For an incorrect answer, the program provides information sources related to the question. The program's information sources function as feedback for the user.

(c) In using the program, a user accesses related knowledge from available links in the program. The accessibility of the program is the feedback from the program to the user.

(d) After using the program, a user explains his/her opinion about the accessibility of the program in a questionnaire and interview. Both questionnaire and interview are feedback from the user to the instructor.

These feedback support data for the evaluation, and they can be visual images, written and verbal explanations, animation, or film clips. Although these feedback have different styles and require different levels of design and
interaction, they all serve the same purpose: to enhance the user's motivation in learning more from the program and to make the program more accessible for the user.

**Student Performance and Improvement**

This part examined the role of evaluation of student performance and improvement as part of the completed multimedia package. Before evaluating, I needed to understand what issues could influence student performance. In addition to this, I needed to know how to collect appropriate feedback for every learning level. According to Hannafin, Hannafin, and Dalton (1993), processing requirements, the role of prior knowledge, the role of active processing, and strength encoding were the most relevant factors to accomplish feedback. These factors were part of the psychological examination for the user's performance in using computer-based instruction design.

Hooper and Hannafin (1991) explained that processing requirements controlled the amount of information given to the user. This control was important because computer technology provides vast and almost unlimited information. Uncontrollable information potentially could overwhelm and distract the user. With the appropriate amount of information in every lesson in the multimedia CD-ROM, the user would be able to select important information, organize relationships among lesson concepts, integrate with existing knowledge, and restructure understanding accordingly (Hooper and Hannafin, 1991).

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4 Strength encoding in this case means the effectivity of the instructional program to convey a body of information in the CD-ROM to the users.
The role of prior knowledge determined the level of difficulty of each lesson. Experienced users would learn more efficiently, collect information accurately, draw conclusions more rapidly, and solve problems faster than inexperienced ones. Based on this, the instructor should measure the level of difficulty for each lesson.

Salomon (1984) wrote that the role of active processing examined how actively the user was engaged in learning with the design. The level of difficulty of the lesson directly affected the user's mental effort. Students would try harder when they dealt with challenging tasks than with the ones they perceived as "easy" (Salomon, 1984). Because of this, the instructor should know when and how to give tasks that would push the users. It was expected that by learning actively, the user could construct a relationship between various information, create hypotheses about relationships, and manipulate them to understand the lesson content.

Hannafin, Hannafin, and Dalton (1993) explained that the strength of encoding relates to the user's understanding about the lesson content. This understanding is gradually built ranging from minimal and superficial (novice knowledge) through authoritative and in-depth (expert knowledge) (Hannafin, Hannafin, and Dalton, 1993). The issues related to the strength of encoding in my research would be the students' experience in working with computer-graphics technology and in using interactive multimedia teaching programs. Advance users with broad knowledge and experience with computer graphics and multimedia technology would only need a short period of time to be able to navigate and explore the IMI CD-ROM. Novice users might need more time to get used to the IMI navigation system and to be able to find important information in the IMI CD-ROM. I designed the IMI
to be users friendly so that novice users would not have serious problems in exploring the CD and accessing all teaching material sections.

Based on Hannafin, Hannafin and Dalton’s theories of evaluation and feedback, I divided the evaluation of student performance into five factors: (1) processing requirement, (2) prior knowledge, (3) active processing, (4) review of the teaching material presentation, and (5) enrichment. The first three aspects were the same as Hannafin’s theory. I did not use his “strength of encoding” aspect because this aspect was included in “active processing.” The last two aspects, review and enrichment, were important in relating to the role of evaluation of student performance and improvement.

Each factor had several items to be evaluated. Explanation of the five different factors was as follows:

(1) Processing Requirement

Items to evaluate:

a. How much information should be given for every lesson?

b. How complex was each lesson?

c. How many times should tasks, quizzes, or questions be given for each lesson?

d. How difficult or complex were the tasks, quizzes, or questions for each lesson?

e. How could the student access related information?

f. How could new knowledge enrich existing knowledge?

(2) Prior Knowledge

Items to evaluate:

a. How could the student’s background support the learning process?
b. How much experience working with a computer was needed?
c. How much art and animation knowledge was needed?
d. What characteristics were needed to use this program effectively?

(3) Active Processing

Items to evaluate:

a. Could students access related information easily?
b. Were students able to construct new knowledge based on their understanding of the lesson material?
c. Did the quizzes, tasks, or questions give students more motivation to learn?
d. How did the students perform on the quiz?
e. How much did multimedia information help students to learn more effectively?

(4) Review of the Teaching Material Presentation

Items to evaluate:

a. How high is the level of interactivity?
b. Do the students’ performances fulfill the learning expectation?
c. How effective is the accessibility of the program?
d. Does the quiz help students understand the lesson material better?
e. Do students gain knowledge from the lesson material as expected?

(5) Learning Encouragement

Items to evaluate:
a. How does the program do in anticipating wrong answers?

b. What was the best approach to student's wrong answers?

It was expected that from feedback, opinion, and data, the instructor would be able to analyze the five factors thoroughly. Evaluations would be made from all five factors. A combination between feedback and evaluation could help the instructor gather important facts about the student's performance. This information would be beneficial to find weaknesses and strengths of both the user and the program. Without evaluation, the art instructor or students would not know if the purposes to design the IMI were accomplished. This was because the instructor would not be sure whether or not the program worked well or how to expand the student's ability more effectively.

My interactive multimedia instruction was created to help undergraduate students learn about Western animation. Because this was the main target, I needed accurate data to evaluate student performance in using the multimedia design. The role of evaluation of student performance and improvement was crucial for creating the multimedia design appropriately.

**Content and Strategy**

I had to arrange the content and strategy of multimedia design that enabled the student to accomplish as much of the project goal as possible. To find out whether or not the design could meet the project goal, the evaluation would be based on the technological perspective that evaluates (1) the design arrangement in presenting the lesson material, (2) the capabilities
of the computer software and the multimedia design, and (3) how to utilize the multimedia design properly. According to Hannafin, Hannafin, and Dalton (1993), there are three primary capabilities to understand the outer limits of technological capabilities: input (response)-output (presentation), symbol manipulation, and management (Hannafin, Hannafin, and Dalton, 1993).

Input capabilities have developed rapidly in recent times. In the past, input of computer-based learning programs had been limited to single letter or short typed responses. Now, devices such as the touchscreen, joystick, and mouse are able to support direct responses as well as manipulation (Hannafin, Hannafin, and Dalton, 1993).

As with input, the current output capabilities were widely developed. In the past, an instructor could only create text-based instructional design. But now with modern computer technology, the instructor is able to produce a multimedia design that has images with various color diversity, animation, motion pictures, and sound.

Icon design was important to present the lesson material as comprehensively as possible. For instance, a user could alter graphics dynamically by using a zoom-in/-out icon. Icons help the user to choose related information or to find information in operating the design. The instructor should know how to choose correct icons for various functions and information. For example, sound or voice icons should look different from animation information.

The management of information is based on various types of data provided by computer technology. Some characteristics of emerging technologies are the capabilities to provide connections with various
computing devices, permitting communication between and among computers of various size, purpose, and sophistication. Unlike in the past, users could access available knowledge electronically via computers, both simplifying and extending the retrievability of extant knowledge. This allows a user to collect related or unrelated data. For instance, by using the multimedia design, a user can find information about a prominent animation pioneer. The user could also establish a relationship to other artists of the period, as well as to authors who influenced, or were influenced by, McCay’s works.

Based on Hannafin, Hannafin, and Dalton’s concept, I divided the technological evaluation into three factors: (1) input and output capabilities, (2) instructional strategy, and (3) interactivity. All factors evaluated some items that are closely related to the content of my multimedia research.

(1) Input and Output Capabilities

    Items to evaluate:
    a. How should the lesson materials be presented? Should they be presented in text only? Or would it be better if I added images or film clips?
    b. How much material should be presented in each teaching section? How many pages the text should be? How many images or film clips are enough for each lesson material? How much resolution the images or how big the film clips should be?

(2) Lesson Strategy

    Items to evaluate:
    a. How could the multimedia design present appropriate assistance for
the user in evaluating the lesson material?

b. How appropriate were the navigation systems of IMI?

c. How should the quiz or questions that related to the present knowledge be presented?

(3) Interactivity

Items to evaluate:

a. What type of interaction is necessary to learn certain lesson material? Should it be presented in visual only? Or would it be better if I added audio, visual, or textual interaction?

b. Is the self-study method appropriate for using the IMI?

To answer these questions, I needed to interview users and give them questionnaires. The users' feedback from the interview and questionnaire would enrich the technological evaluation because they would show the quality and quantity of data sources that portrayed the actual condition of the multimedia elements. They would also enable the instructor to find out how to rearrange the design to meet the project goal.

The Teaching Material of the IMI

The major teaching materials of the IMI are the historical and theoretical aspects of Western animation. Most teaching materials were presented in textual forms. I inserted still images, film clips, and music that were relevant to the text.
The historical aspects of animation are divided into several major sections such as commercial, experimental, and pioneers of animation. I did not find any difficulties in finding resources for commercial animation, since this is the most popular and entertaining type of animation. There are numerous books and videotapes about Warner Brothers, Walt Disney, and Hanna-Barbera cartoon animation. Most information on commercial animation in the CD-ROM is taken from *Enchanted Drawings - The History of Animation* by Solomon (1994), *The 50 Greatest Cartoons* edited by Beck (1994), *Cartoons - One Hundred Years of Cinema Animation* by Bendazzi (1994), and *Animation Magazine*.

Solomon's book provided comprehensive information about the history of Western animation in general from the 1920s to the present. He also examined the invention of early animation devices and includes illustrations of the devices. In *The 50 Greatest Cartoons*, Beck provided a thorough description of 50 great short animated films that achieved Academy Awards or that play an important role in the development of commercial animation. Bendazzi's *Cartoons* contains explanations about the development of commercial and experimental animation around the world, such as animation from Asia, West and East Europe, Latin America, and North America. He includes complete descriptions of influential animated films, the stories of the artists, and various animation styles.

*Animation Magazine* provided important information about current animation trends and technology. The magazine also presented interviews with many prominent commercial animation directors or producers such as Jay Ward, Chuck Jones, William Hanna, and Joseph Barbera.
I have written teaching material on the social aspects of animation for my master's thesis, titled *The Art Curriculum of the Social Aspects of Animation* (1992). In this thesis, I created an animation curriculum for art education undergraduate students. The teaching material focused on the social aspects of animation, such as how the social condition affects the production of animated films, how the animated film contributes to the development of society, and how the development of technology affected the appearance of animated films.

**The Pioneers of Animation**

Unlike commercial animation, it is much harder to find resources about pioneers of animation because most of the classic animated films were destroyed or lost. Most people today do not know that the world of modern animation started in the early 1900s and that many animation pioneers are forgotten. Few books are written about these pioneers because their animated films are not popular and only a few people are interested in them.

There are many important pioneers of animation in the U.S., but I only examined four: Winsor McCay, Emile Cohl, James Stuart Blackton, and John Randolph Bray. They are the earliest individuals who made modern animated films in commercial and experimental ways. Their animation styles influenced the development of the animation field internationally.

Most of my information about the animation pioneers is taken from *Cartoons - One Hundred Years of Cinema Animation* by Bendazzi (1994) and *Before Mickey - The Animated Film 1898-1928* by Crafton (1987). Bendazzi provides thorough information about all four pioneers, especially Winsor McCay and Emile Cohl. He also included several still images of the pioneers'
artwork. Crafton's book provided the most complete information about various Western pioneers and their animated films. He explained in detail the personality and animation career of each person, how they developed their animation styles, for whom they were working, and how they marketed their films. In addition to his book, Crafton also produced a videotape containing pioneering animated films starting from the 1900s to 1925. This videotape is essential to understanding the appearance of early animated films.

Besides explaining the history of early animation, Crafton also examined the characteristics and personal life of each pioneer. He related the social condition with the animator's achievement to the time. For instance, Crafton reported that the Felix the cat character was not created by Pat Sullivan as most people thought, but by Sullivan's employee Otto Messmer. At that time, people thought that Sullivan invented animated films in 1933; such films actually had been produced since the 1900s. Most animators were not known and therefore received no credit. If the animation character became popular, the animation producer gained all of the profit and fame.

The Techniques of Animation

In the "Techniques of Animation" section, I covered the inventions of the most influential animation devices since the beginning of the animation field in the eighteen century to modern day. I also included the inventors' names, the explanation about how the devices worked, the animators who started to use the devices, and the relations between each invention. The examples of devices that are covered in this section are the magic lantern,
flipbook, zoetrope, thaumatrope, cel animation, clay animation, and
computer-graphics technology.

The only book I could find that explained the invention of the magic
lantern was Solomon's *Enchanted Drawing* (1994). Solomon included
several pictures of early magic lanterns. For additional information, I
searched the Internet for facts about magic lantern. Fortunately, the
Smithsonian Art Museum homepage presented news about its art exhibition
of motion picture instruments, including early magic lantern devices.

The only book that explained the history of clay animation in the U.S.
was *Clay Animation - American Highlights 1908 to Present* by Frierson (1994).
Although Solomon's *Enchanted Drawings* and Bendazzi's *Cartoons* also
provided information about clay animation, Frierson's book was the most
comprehensive. Frierson explained who created plasticine clay, how clay
animation started in the U.S., why it is not as popular as cel animation, and
current developments in clay animation.

From various books about computer graphics, I found *Digital Visions -
Computers and Art* by Goodman (1990) and *Computer Graphics* by Lewell
(1985) to be the most interesting and easy to understand. In her book,
Goodman describes the history of computer animation. She started with the
very early use of computer technology in animation, and explained how
artists started being interested in using the technology for artistic purposes,
and how computer graphics influences the field of animation in general.
Lewell described the history of computer graphics in commercial, industrial,
and educational fields. He explained the technical process behind the
complicated computer technology and related the process with the output.
The Principles of Animation

From various principles of animation, I chose only six principles: (1) squash and stretch, (2) ease-in and ease-out, (3) follow through, (4) timing, (5) staging, and (6) anticipation. These principles are the most basic and commonly used in modern animated films. The application of these principles is essential to present a convincing and realistic story, to depict certain characteristics of the animation characters, and to show a surprise or a shocking event successfully.

Explanation about the steps of creating films and principles of animation can be found in *Animation from Script to Screen* by Culhane (1988), *The Technique of Film Animation* by Halas and Manvell (1976), *Enchanted Drawings* by Solomon (1994), and *Viewpoint* (article) by Lasseter (1994). These books and article contain an explanation about the application of the techniques and principles in commercial and educational animated films.

Culhane and Halas and Manvell provided interesting illustrations of the principles of animation. They also described how these principles influenced their own work. For instance, Halas and Manvell explained how they created and applied the principles for the animation characters of their animation, titled *Animal Farm*. Solomon only provided textual information about the way the principle worked in some Disney's classic animations such as *Fantasia*. 

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CHAPTER 3

THE DESIGN PROCESS OF
THE INTERACTIVE MULTIMEDIA CD-ROM

The description of the significant aspects and techniques in designing an instructional interactive CD-ROM is divided as:

(1) Design issues
   a. interface/layout
   b. background
   c. interactive selection options
   d. font style and size
   e. color

(2) Choice of authoring software
   a. options available
   b. issues affecting the decision of authoring environment

(3) Planning for content
   a. types of teaching materials
   b. copyright and fair-use doctrine

(4) Use of animated films and film clips from videos

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a. methods of video capture  
b. editing the video  
c. including video in the interactive experience  

(5) planning for navigation  
  a. how a student gets around in the CD-ROM  
  b. branching  
  c. library resources  

(6) Methods and procedures for mastering  
  a. arranging quizzes  
  b. instruction strategy  

Design issues  

To effectively use the IMI, users had to understand how to use it. If the user was confused using the IMI, it meant the design did not function as expected. Schwier and Misanchuk (1993) wrote that the interactive multimedia designer should remember some important principles in the process of creating it: simplicity, consistence, clarity, and aesthetic considerations such as balance, harmony, and unity.  

Interface/Layout  

The main purpose of the interface is to be as clear as possible while conveying various functions and messages. For this reason, I had to present the lesson material on an undistracting background. The entire interface in the IMI design had to appear in the same tone of colors, typical types of textures, and the same icon placements.
Background

The background was designed to support the appearance of the textual overlays, icons, or buttons. The background was presented in a contrasting color to the information placed on top of it. For aesthetic considerations, some animation characters were placed on the background with very light color tones that would not distract from information on the screen.

Interactive selection options

The interactive process in IMI was represented by clicking the screen with the mouse cursor, moving an object on the screen, selecting an item, and popping up a menu from certain buttons. By clicking the navigation button (Figure 3.1), the user could access any link in IMI. It was important that the user know the function of each button before using it. Failure to understand this might cause confusion and discouragement. Examples of interaction can be seen, for instance, in the quiz area. In the "Multiple Choice" quiz area, the user can click a button to choose the correct answer. In the "Matching Puzzle" quiz section, the user needs to drag an image to the correct box. In the "Jigsaw Puzzle" section, the user has to place the puzzle pieces in the correct order to see a still image.

Font style and size

Schwier and Misanchuk (1993) explained that unusual font style (italic, bold, underline, condensed, shadow) should be used sparingly for good writing style of instructional materials. I decided to use Palatino font, size 12 to 14, and plain style for textual information. For an important or
meaningful word, I applied a bold style or different text color. Italic font was usually used for introducing technical terms, titles of books, and specialized applications.

**Color**

The application of colors was important to make the interface design interesting, yet communicative. I applied slightly darker earthy colors for the background and lighter earthy colors for the foreground. Combinations of strong colors and textures were used to show important icons and buttons. Most colors and textures were created in Adobe Photoshop with KAI plug-ins and Painter software.

Although the color combinations for each section were all different, I tried to use a similar visual style for the overall design. I designed the IMI to be dynamic, full of color, but to still appear harmonious and unified. I always used similar texture and background composition for each screen.

**Choice of authoring software**

It was important to relate the capabilities of the authoring program with the knowledge content and the user. Since the subject was about Western animation, the program presented many still images, film clips, sounds, and texts. The authoring software helped me to present the teaching materials with a clear navigation system.
Options available

There were several authoring programs considered for creating interactive multimedia design to teach Western animation: Amiga Visions (Amiga), HyperCard (Macintosh), Authorware Professional (PC, Macintosh), and Macromedia Director (Macintosh). Macromedia Director was used because it has a powerful animation arrangement program. It was also compatible with other sophisticated image-processing software and film-editing software such as Adobe Photoshop, Premier, Illustrator, Fractal Design-Painter, and Movie Player.

Boves and Rhodes (1994) explained the capabilities of Macromedia Director: (1) the Macromedia Director offers high portability since Macintosh is a popular computer brand for education purposes. It works with the "What You See Is What You Get" (WYSIWYG) system that was practical for the instructor in presenting the lesson material. For understanding art knowledge, a user should see clear presentations of visual language elements such as colors, lines, forms, and textures. The program allowed the instructor to combine formatted text, graphics, video still images, digital video movie files, video from analog sources, transition effects, automatically animated text and graphics, and prerecorded sound and music to create and edit presentations (Boves and Rhodes, 1994).

Issues affecting the decision of authoring environment

According to Schwier and Misanchuck (1993), the important aspects in choosing an authoring program can be divided by:
a. Licensing Agreements

This aspect was important to consider before choosing a program since the instructor or educational institution might plan to distribute the multimedia designs. Every company had a different policy. A comprehensive program such as Macromedia Director was expensive to purchase initially, but as long as the author mentioned the Director's name, the company allowed unrestricted distribution of products made using them.

b. WYSIWYG

With this system, the instructor could immediately see the result after editing and developing the lesson material without converting it to another format. This nontedious condition helps an instructor save time and effort when dealing with any significant amount of correction.

c. Integration of Peripherals

It was better to choose an authoring program that allowed a number of peripheral devices that could be tied together with the system. Integration increased the quality of lesson presentation for the program. In collecting data for my CD-ROM, I used devices such as videocassette players, CD-ROM players, audiocassette players, video digitizers, and a video editor.

d. Text Composition

A comprehensive word processor was necessary to help me arrange the textual explanation clearly. I started writing all the text in IMI with ClarisWork word processor and then transferred all text to Adobe Photoshop and Director. I could directly work in Director to edit, scale, and color the text.
The next step was to arrange it so that it would fit the space in every section in the IMI.

e. Graphics

This aspect was fundamental for presenting the teaching materials in the IMI. An authoring program should have the ability to create, edit, and/or import graphics easily. A reliable authoring program should offer clip art, palette editing, cut and paste functions, fat-bit editing, vector-based drawing, and importing from standard graphic packages. Although I used Director to edit still images and background decorations, I still had to do image processing in Adobe Photoshop. Photoshop enabled me to process the image after I scanned it. Photoshop also provided layer and panel separation in which I created visual effects, such as bump map, texture map, lighting, and shading, in either the foreground or background of a still image.

f. Animation Features

Animation features were an essential part of the IMI lesson materials. I arranged simple animations in Director, such as a flying logo, a flipping character, and moving buttons. Director provided motion control, in-between frames development, and sound application. However, I had to use a special animation software to create more complicated animations. For instance, in the "Principles of Animation" section, I provided six 3-D animated films. The films were created by using Strata and Infini-D software. I applied synchronized sound in Adobe Premier and saved it as a QuickTime movie file. Once it was done, I could import the file to Director.
Planning for content

The content of the IMI was based on the topic of my Master's thesis (Wayanti, 1994). There were four major sections in IMI: "History of Animation," "Pioneers of Animation," "Techniques of Animation," and "Principles of Animation." In addition to these sections, I created a quiz section that covered the lesson materials about the history, pioneers, and techniques of animation. By taking the quiz, the users could assess this animation knowledge.

Type of teaching material

The type of data in the IMI includes: text (word and numbers), audio (music and sound), visual (still image, movies, and animation). Text was the main teaching medium because it imparted comprehensive information about the history, pioneers, techniques, and principles of animation. The visual information was given for each text to enhance an explanation of the subject. For example, if the text explained Walt Disney, the user could click on the word "Walt Disney" with the mouse cursor to see a picture of him. The word appeared in bright red and could be easily distinguished from the black text. When the user rolled the cursor to this red word, the cursor changed from an arrow to a pointing finger. By seeing the form of the cursor, the user would realize that he/she could click the word to see still images. I consistently used the same color and cursor form for all clickable words in the entire lesson materials in the IMI.

I provided a list of all film clips in the IMI in case the user wanted to
see them. The user could find the film list by clicking the "Index" button that could be found in almost all frames of the IMI.

Because of memory restrictions, the amount of film and animation had to be carefully organized. I only chose the most phenomenal short animated films or features in the history of animation, such as *Gertie the Dinosaur*, *Snow White and the Seven Dwarfs*, and *Rooty Toot Toot*. The user could hear the music and sound in each film example. Music played a very important role in certain animations. For example, in *Pas de Deux* by Norman McLaren, all the characters' motions and forms relied heavily on the music.

**Copyright and fair-use doctrine**

A copyright is the exclusive legal right to reproduce, publish, and sell the matter and form of a literary, musical, or artistic work (Meriam-Webster, 1989). A legally protected product cannot be reproduced in any way for any purposes without having permission from the person or entity holding the copyright on the product. A copyright protects the nonphysical product of the mind rather than physical products. This means that the idea or concept of a product is protected. A copyright is commonly referred to as a form of "protection of intellectual property." Beside copyrights, there are other types of intellectual property such as patents and trademarks. A patent protects an inventor against the unauthorized production, use, or sale of an invention. A trademark is used for a word or symbol associated with the source of a particular product of a service. For example, the word Coca-Cola is legally protected to prevent its use so that the public will not be confused about the source of this product (Grolier, 1995).
To procure permission on a legally protected product will depend on the reproduction purposes. For instance, it is more difficult to have a copyright permission for commercial purposes than it is for educational purposes. For commercial purposes, the person who asks for permission is likely to profit from the product. It is not really clear what fraction of a product that you could copy from a book or visual image. Some individuals and libraries decided that someone who did not own the copyright should not take more than 10 percent of the original work or no more than 60 consecutive words. No matter what the case was, it was important to have permission for using or developing a legally protected product. The same goes for using the visual images, sound, animations, text, and short films from the IMI. The IMI designer should ask for permission to use these products from animation companies.

Schwier and Misanchuk (1993) explained that asking permission could be either very easy and inexpensive or very difficult and expensive. Some of the copyright holders of the materials I used were very generous, while the others demanded exorbitant fees. Obtaining copyright permission can also be very time consuming. Sometimes one needs to wait up to one year before receiving a final written agreement. For me, it was usually faster to ask permission via telephone or fax machine. Some copyright holders also asked for a copy of the finished work for their files.

Due to the copyright issues, the IMI CD-ROM would not be marketed or distributed for any purposes. The committee members of my research will keep the copies of the IMI CD-ROM for further development and evaluation of interactive multimedia designs.
The Use of Animation and Film Clips from Video

Methods of film capture

The hardware to capture audiovisual presentations from videotapes was PowerMac 8100 with software such as Adobe Premiere, Photoshop, and Video Vision. After digitizing the audiovisual information from a videotape to a computer screen, I compressed and saved it as QuickTime Movie file. This file was then easily imported to Macromedia Director software.

Editing the video

I collected 40 videos from various video rental stores, campus libraries, Columbus Central Library, and video-production companies. From these 40 videos, I found 50 films that I needed. My first step was to edit each animation. I tried to capture eight to ten seconds of film that could essentially represent the whole film. For instance, in John Hubley's The Carousel, I only took the beginning of the film that explained the concept and process of the life in the film.

I also included my own eight 3-D animated films in IMI. Six of these films were about the principles of animation. One film explained flip books, and the last film explained how a zoetrope works.

In addition to the teaching material film clips, I also used at least ten animated films that function simply as entertainment or to make the IMI more attractive. Such film clips can be found in the beginning of major sections of the IMI.

I had a total of 56 film clips for the IMI CD-ROM. I could edit simple
animation such as flying logos and moving objects in Director. I imported each animation frame as an object in Director and then I applied all the frames to the Director film. The easiest areas to edit a movie in Macromedia Director were in the Score window and Export and Import menus. These areas allowed me to adjust the movie tempo or speed, to apply color cycling effects, and to arrange the color palette.

I was able to slow down the tempo settings of the animation file by adjusting the frame rate. This technique reduced the number of frames per second. The time base used for video in the North America equals thirty frames per second (fps). Based on my experience, I can reduce down to fifteen frames per second and still have a reasonable end result. Any lower reduction would make the motion look jerky.

Most film clips from videotapes were edited in Adobe Premier. The process was quite simple because I only had to determine the start and ending of each film and let the software cut it for me. I used Cinepak compression from Premiere because it reduced the required memory size while still maintaining a reasonable visual quality.

Because of the data storage problem and the average capacity of the computers to run QuickTime movie files from a CD, I choose 8-bit to 16-bit color setup for all film clips in the IMI. The size of film clips varied from 250x150 to 350x350 pixel size. I could not create a large format because the film would not run smoothly on older machines, and it would take too much memory.

After I organized the film clips in the IMI, I downloaded all data in the CD and tried to run it in various platforms. Although they were all computers, they had different capacities and did not run my CD at the same
speed. Some of computers used a 2X speed CD player, while the others had 4X speed. I wanted to make sure that my CD could run well on all Apple computers. When I found out that some computers with limited memory could not run the film clip, I decided to reduce the size of my film and recompress the film clip. I did the same test at least ten times by using five to eight CD-ROMs until I was sure that it could run well in most Macintosh computers on campus.

**Including film clips in the interactive experience**

Boves and Rhodes (1994) explained that, in general, there are two categories of video format: analog and digital. Usually, people use the analog more often than the digital category. Most video stores provide video recorders and home VCRs that can record and play analog video on VHS tape. Digital video is a new form of video that is digitized and stored on a hard disk or CD-ROM. Macromedia Director can import both types. To create digital video, one can use a video capture card (such as VideoSpigot from SuperMac for the Macintosh) and use an analog video camera or VCR as a source.

The use of film clips in interactive multimedia program was uncommon before the invention of the QuickTime film capture technique in the Macintosh system. With this technique, I easily included any necessary part of the films in IMI. It was very effective in helping the user to understand the text by seeing the film. For example, a film clip of *Steamboat Willie*, a short animation, was a good example of the first appearance of early animated sound film. By showing a film clip, I did not have to write long
explanations nor add a lot of images to give a comprehensive explanation about a subject.

**Planning for Navigation**

It is necessary to arrange a clear navigation system to give users access to all areas. The navigation buttons had to be effective for users to get around in the IMI without becoming confused. If the users did not know how to leave from, or go to, a certain area, they would feel lost. Acquiring information would not be easy, because the user would not know where he or she was. This would make it difficult for the user to create a learning concept of the things he or she needed to know before learning further curriculum material.

For this reason, I provided a clear navigation system for the user. The easiest way to arrange direction and position information was by using symbol and logo buttons (Figure 3.1). There were ten main navigation buttons in IMI: "Main Menu," "Next Page," "Previous Page," "First Page/Previous Section," "Last Page/Next Section," "Main Map," "Where am I/Pop-Up Map," "Index," "References," and "Quit" buttons. The "Main Map" (Figure 3.2) provided access to any link or area of the IMI. By clicking the "Where am I/Pop-Up Map" (Figure 3.3) button, the user could see the general map of all branches and areas in the IMI. The "Index" (Figure 3.4) was the area where the user can find animation films, directors, producers, companies, and animators listed alphabetically. The "Index" area also provided a list of all film clips available and the bibliography in the IMI.

Not all navigation buttons could be applied in every window, because
Figure 3.1: navigation buttons of the IMI teaching material
Figure 3.2: main map of the IMI teaching material
Figure 3.3: "Where am I/Pop-Up Map" navigation function of IMI
Figure 3.4: the "Index" section of the IMI
certain areas needed only particular navigation symbols. Nevertheless, the "Main Menu" and "Quit" buttons were available on each page. Whenever the users decided to exit, they could just click the button and quit the program immediately. The "Main Menu" area presented four major areas of the IMI, such as the "History," "Pioneers," "Techniques," and "Principles of Animation." The "Reference" button was always available on every page, and it revealed lists of reading materials. Whenever the user pressed the reference button, a pop-up reference showing the resources of the readings appeared.

All the navigation logos and information were placed on every window of the IMI in the same position, color, and texture. With this consistency, the user could remember the functions of each logo more easily.

Branching

The branching system of IMI is described in Figure 1.1. Schwier and Misanchuk (1993) explained that there are three systems in interactive multimedia teaching design: linear, user-directed, and review branching systems. The linear branching system was sequential, unidirectional, and predetermined by the producer (Figure 3.5). The user-directed (Figure 3.6) and review branching system (Figure 3.7) allowed the users to review the information whenever they needed to or when they answered incorrectly on the quiz.

I applied combinations of these three branching systems in the IMI. For quizzes and answer evaluation, the user-directed and review branching system were more useful than the linear branching system. The linear branching system did not allow the user to find a thorough explanation
concerning the quiz answer. Nevertheless, the linear system was appropriate to give a step-by-step explanation. For instance, to explain the history of commercial animation production, I could divide the explanation from the earliest to the latest era and present each era in a linear branching system.

I designed the quiz to help users learn some information. If they could not answer a question correctly, they could go back to the reading to find the information. I created an "Information" button for each page in the quiz section to provide some clue. For instance, for a question about rotoscope, the clue would say the information could be found in the "Techniques of Animation" area.

![Figure 3.5: the linear branching system](image)

![Figure 3.6: example of the user-directed system](image)
Figure 3.7: the example of the review branching system

Figure 3.8: the IMI branching system
Figure 3.8 showed the way I organized the learning system in IMI. Material 1 consists of three items (materials 1.1, 1.2, and 1.3). The users could either read these materials in chronological order or chose each one of them in the list of teaching material in IMI. The quiz was presented after the users learned any of or all three materials. The user had to choose to take the "Matching Puzzle," "Jigsaw Puzzle," or "Multiple Choice" quiz. Whenever the users answered correctly, they could go to the next material (Material 2). But if the answer was incorrect, they could review the correct answer from the Material 1. If they did not want to have the quiz, they could go directly to the Material 2. The IMI tried to provide the most flexible program but it was up to the users whether or not they wanted to have a quiz.

Library resources

I created a "References" button in each text page of the IMI. Whenever the user pressed this button, a list of resources would appear. I also put numbers in the middle of the text and the user could match these numbers into the resources to find out which books I could be referenced for further information. Each different reading had its own references. For instance, the "Disney - World War II" reference was different from the "Disney - Present Era" reference.

In order to enable the user to see the resource list instantly, I designed the "Reference" button to function as a pop-up menu. This meant that the references only appeared when the user pressed the button. Once they released the button, the references disappeared.

In addition, I also provided another list of the bibliography. The user could access this list by pressing the "Index" button. As with the "References"
button, the user could find the "Index" button on almost all pages of IMI. The "Bibliography" revealed all books, magazines, theses, and articles that I used to write the teaching materials.

I also provided complete information on still images and film clips. For instance, for the Mickey Mouse still image, I applied the name of the animator, the year when the image was created, the animation production company, book's title, book's year, book's page, and the author's name.

For those who wanted to look up subjects alphabetically, the "Index" section was the right place to go. For instance, if the user tried to find information about Norman McLaren, he/she could press the "M" letter and then search and click the button for "McLaren." This button would instantly take them to the McLaren reading material. I designed the functions and links to provide the maximum potential for gaining information from the IMI.

Methods and Procedures for Mastering

As a learning tool, the IMI CD-ROM should provide a facility to help students master the curriculum materials. I created the quiz sections with three different types of quizzes, such as multiple choice, jigsaw puzzle, and matching puzzle.

Arranging quizzes was useful for both the instructor/designer and the students/users. Without giving quizzes, the IMI would function merely as an animation encyclopedia. The quizzes were also useful in providing information concerning whether the teaching materials were too easy or too
difficult for the students. Additionally, the users could find out how much they knew about the IMI material.

The Quizzes

They were two ways to access the quiz area. The first one was by clicking the "Main Map" button and going to the "Main Map" section. In this section, there was a button called "Quizy DizzyLand." When this button was clicked, the user would access the quiz section instantly.

The quiz area could also be accessed whenever the user reached the end of each reading materials. Then, the user would read a question: "DO YOU WANT TO TAKE A QUIZ?" If the user pressed the "NO" button, then IMI would take the user back to the beginning of the reading material. But if the user pressed the "YES" button, then the quiz area would be opened.

Inside the quiz area, the user had to choose a quiz about the history, pioneers, or techniques of Western animation. After deciding on the quiz, the user could choose the type of quiz to take: multiple choice, matching puzzle, or jigsaw puzzle. The user would need to interact with the program to answer the question or solve the quiz problems.

In each "Multiple Choice" quiz, there was a statement or question with four answer choices. The user had to choose the correct or most closely related answer to the statement by clicking the answer button. If the user pressed the correct button, a complete explanation of the question would appear. For further information, there was an information button for each page of the quiz. Whenever the button was pressed, a pop-up information page would appear telling the user how to access comprehensive information about the question. For instance, if the question was about the 101 Dalmatian
feature animation, the pop-up information explained that the Disney Feature Animation area provided a comprehensive explanation about the making process and important aspects of the film.

In "Matching Puzzle," the user had to drag images, letters, or words to the correct boxes. For instance, in the quiz about the techniques of animation, there were six types of animation devices and six boxes with inventors' names labels. The user had to drag each device to the correctly labeled square. As in the "Multiple Choice" quiz, there was an information button on each question that explained the names of the devices and the area that provided complete information about the devices and inventors.

The "Jigsaw Puzzle" functioned more as an entertainment than a real quiz. The still images of the puzzles were taken from important commercial and experimental animated films, such as *The Sinking of Lusitania* by Winsor McCay and *The Adventure of Prince Achmed* by Lotte Reiniger. By seeing and playing with the picture, it was expected that the user would remember the films and would be encouraged to find out more about them.

I tried to create an incentive every time the correct answer was chosen by presenting interesting music, still images, and cycling of the computer color palette. I had to create a Lingo in Director that would change the color setup from 16-bit to 8-bit (256 colors) to cycle the whole 256-color palette. This made the computer screen very colorful and flashy.

In the IMI CD-ROM, I created both Macintosh and Windows versions. To run the CD properly, it required at least 8 MB RAM with 2 MB free memory, and 16-bit color monitor. A CD player drive with 2X running speed could play the CD properly. With these minimum requirements, I expected that the CD could run in all Macintosh and Windows computers.
Nevertheless, I still faced a technical problem with the Windows version of IMI. The IMI Windows version would not perform the color cycling in the quiz sections at all. The problem did not only appear in the quiz section but also in the film clips presentation. Another problem I encountered was that most PC computers were able to download the QuickTime movie file on the screen, but some computers could not do it.
CHAPTER 4

METHOD OF ANALYSIS

In this chapter, I explain the case study method of analysis I used to collect and examine research data. This method was chosen based on the characteristics of the method and the lesson material I created in the IMI.

Case Study Method

According to Stake (1988), the case study method was useful to portray an educational problem in all its personal and social complexity. Stake explained that the focus of attention of the research is the case, not the whole population of cases. The research is arranged for creating an understanding of the particular case, in its idiosyncrasy, in its complexity (Stake, 1988).

Stake explained that a case study researcher usually arranges a careful plan of observations in natural settings and interviews, qualitative analysis, and narrative reports. The participants of each case were described in terms of age, race, rank, or degree. Because the researcher studies each case, the researcher should find its character, totality, and boundaries. The result was
not something that could merely be represented by an array of scores. Each case is complex and dynamic, and the researcher should find its complexity (Stake, 1988).

I believe that the case study method is appropriate for arranging the data analysis of my research. The role of participants in my research was crucial. Without participants, the research would be meaningless. Based on my teaching experience in computer-graphics courses, I realized that while the whole class used the same software and hardware, each student had different experiences. I believe this happened because each student is unique. For this reason, I decided to deal personally with each participant in my research.

As Stake mentioned, I had to determine the natural study of my research before collecting data. The subject of the research was the IMI CD-ROM. The only way to use it to its advantage was by testing it and learning from the experience. Thus, my research was a natural study of teaching and learning in one setting. The case of research was the IMI teaching design. The case study in my research privileged the participants because they were so important in the teaching and learning situation. The next problem would be setting up a system of boundaries in the research. According to Stake, the system boundaries are important to determine a pattern of behavior that explains interaction process, the reason for doing similar/different action/reaction, and the principle of giving instruction (Stake, 1988). Stake (1988) explained:

> What the researcher looks for are the systematic connections among the observable behaviors, speculations, causes and treatment. (p. 255)

I set up boundaries by choosing no more than ten undergraduate
students. Too many students would prevent me from concentrating on each case thoroughly. I decided that they should be students of The Ohio State University who would be able to meet me often on campus. I did not limit participants by academic disciplines. I did this because from my teaching experience in the past, I realized that many students from various majors are seriously interested in learning about animation. Nevertheless, it was important for me to know their motivation to participate, their average grades, their artistic ability, and school rank. By knowing about this, I could anticipate their potential to use the IMI.

The fact that participants used the IMI CD-ROM with the same time length and learning method could be considered a research boundary. This boundary would help me determine the questions about important aspects in the CD, such as the clarity of teaching material and color combination of the background.

After setting up boundaries, Stake stated it is necessary to search for patterns. He said that all researchers are interested in regularity and consistency. The researcher could find these patterns even from the most unique of persons or from the most unique curricula.

To find patterns in my research, I had to understand types of users in the interactive multimedia teaching and learning system. According to Fischer (1988), there are three types of users in an interactive teaching method. The first one is a freedom user who has total freedom to access any type of information at any time. The next type is a structure user where the instructor directs the user's information accessibility to fulfill certain learning expectations. And the last one is the explorer type where the instructor lets the user access a particular type of information at will (Fischer, 1988).
If the instructor decides to treat students as freedom users, it means that he/she has enough confidence that the students are responsible enough to build their own knowledge. This means the students must be mature enough to make their own decisions to broaden their knowledge. Fischer wrote that:

... freedom users can find themselves, and this is the most important aspect for individual development. This role enables students to be counter-productive because it forces students to learn what they may not yet be interested in learning. Freedom entails the possibility that students will never get off the mark and find either themselves or their way through the desired material. (p. 301)

With a structure user, the instructor creates a structured environment to determine what area should be roamed, what information should be read, what quiz should be taken, and so on. In this case, the instructor treats the students as less mature users. The benefit of this system is that the instructor can direct the students' learning process. This means there is a greater chance that the class expectation can be achieved. The students will learn something, however unwillingly. Although this system may look very restrictive, sometimes the instructor has no choice but to use it because otherwise the students will learn very little from the class material.

Fischer explained that as with the freedom users, the instructor treats the third type of users, the explorer, as mature persons. As in the real world, explorers are people who have invested their limited resource of time and money in travel to a self-selected place they wish to know better (Fischer, 1988). To access the information they need or master the subject, the users have to deal with various approaches. At the end, the users put information together, build their assumptions, and come out with some hypotheses.
To anticipate what type of users would use the IMI CD-ROM, I needed to know the students' capabilities. For freedom and explorer types, the users need experience working with computer-based teaching systems. For a novice user, having unlimited information would be overwhelming instead of helpful. To overcome this problem, I also had to measure the portion of lesson material for each section in the IMI so that it would not be too much for the user.

I might find the patterns of my research by examining the issues that might occur during the trial. The issues were divided into objective and subjective issues. The objective issues would be about the facility of using the CD, the presentation of teaching materials in IMI, the clarity of my writing, the accessibility to all sections in the IMI, and the effectiveness of the navigation system. The subjective issues would be about student preferences of learning, individual learning pace, personal artistic taste, and personal interest about a particular subject in animation. For instance, some students might have difficulty reading text on a computer screen, while the others might not. To find out about these issues clearly, I decided to use triangulation\(^5\). According to Stake (1988):

> The idea of triangulation comes from sociology (and further back, from navigation at sea). The technique is one of trying to arrive at the same meaning by at least three independent approaches. Naturally a finding that has been triangulated with several independent data-holdings is usually more credible than one that has not. (p. 263)

The triangulation approaches of my research were: (1) direct

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\(^5\) According to Webster's Ninth New Collegiate Dictionary (1989), triangulation is the measurement of the elements necessary to determine the network of triangles into which any part of the earth's surface is divided in surveying; broadly: any similar trigonometric operation for finding a position or location by means of bearings from two fixed points a known distance apart.
observation, (2) interview, and (3) questionnaire. All three approaches were conducted to find out the user's opinions and experiences in working with the IMI in details. Comparison of the three approaches helped me to find out whether there were some consistencies in the user’s opinion. This system was arranged to prevent the user from giving inaccurate answers.

In the IMI case studies, I expected the student to collect information and facts and to be able to evaluate them. Rockart and Morton (1975) explained the methods of data analysis and presentation that were needed to present the results of case studies. The case studies method is an efficient method to be used in the areas of analysis and presentation. Before starting a case study, students had to find out how to use the IMI and to get information out of it. Once they learned something, they were offered the opportunity to take a quiz. In order to solve the quiz problem, a student must develop "attentive reading" skills - the ability to carefully read and analyze materials presented to him/her (Rockart and Norton, 1975). If the IMI was organized properly, a student might be able to present and evaluate data accurately and be able to answer the quiz correctly.

Method of Selecting Participants

I planned to ask ten undergraduate students to participate in my research, and I would then examine each of student's experiences carefully. The users would have to use the IMI without the presence of an instructor because the IMI was designed as a self-study learning tool. It was expected that by self-study in this program, students would learn the general concepts of the history, pioneers, techniques, and principles of animation. Students were
allowed to determine the place and time to use the program. They could use this program at any time and anywhere, wherever facilities were available.

To be sure that users would have no difficulties in using the program, it was important to determine their skill level and other characteristics before they used the program. Once it was determined, I had to decide for whom the project was created, who the users would be, and what experience a user should have to operate the program properly.

Although all users have different problem-solving abilities, I needed to decide some standard ability and characteristic for the users. According to Hudspeth (1993), a list of the characteristics might include:

- (1) basic academic skills (reading comprehension, general reasoning ability, problem-solving skills);
- (2) lesson-specific entry knowledge (vocabulary, symbols, recall of procedures, use of formulas and equations);
- (3) ability to engage in instructional strategy (team skills, rote vs. didactic, prepare a specimen, matrix or graphic);
- (4) processing mode (audio/visual/kinesthetic preference, ability to monitor self, holistic vs. serial thinking, procedural vs. exploration); and
- (5) motivation (internal vs. external, self-imposed vs. peer or teacher imposed). (p. 297)

The important qualifications, such as basic academic skills and lesson-specific entry knowledge, could be found out from direct conversation with the students or their instructors, examination of their writing skills, artwork assignments, and academic accomplishments. Some users might equally learn as quickly from audio as well as visual information, while others may not. Some might learn well from a nonlinear learning experience, while others may not. Each of these factors could be measured and used to create a more appropriate learning system to satisfy individual differences.

Besides users' knowledge background and abilities, it was important to
distinguish the types of learning materials in the IMI. In the discipline of art, for instance, the teaching materials could be divided into two major categories, theory of art and artistic practical training. The theory of art includes courses such as philosophy, history, aesthetic, and criticism of art. The practical training includes courses such as image processing, painting, sculpting, and ceramics. The first set of categories deal more with historical facts, assumptions, definitions, or manifestoes in the world of art. The second set of categories deal more with the art making techniques, color, composition, artistic values, or art media. All this information could be imported to the multimedia-based teaching program. The students could easily access the information through the computer screen. Now the question was how much could one understand this information from a computer-based teaching program?

In a traditional classroom, the instructor would often have to discuss the information from both categories with the students. The discipline of art is heavily influenced by social values, art phenomena, economic development, and popular interest. There are no absolute truths or values in the world of art and many art definitions can be challenged. This was why it was important to arrange a class discussion so that students could broaden their minds about ambiguity in art. By sharing opinions with others, students would have a chance to question or evaluate artistic ideas or philosophies. The instructor could function as a motivator or navigator. As in art theory, class discussions and student-instructor interactions are also important for artistic practical training. The students needed to have an art instructor’s feedback to develop their artistic skills. Since determination of aesthetic values of an artwork is very subjective, students have to explain
their artistic ideas to the instructor. On the other hand, an instructor would evaluate the artwork and give some input or feedback to the students.

These important class discussions, seminars, student-instructor interactions could be easily arranged in a traditional classroom, but not in a multimedia-based teaching program. The computer could not spontaneously evaluate the composition, colors, creativity of students' artwork. The program could only be designed to record certain art critiques of a particular artwork. And it could only interact with the users based on the programmed information. Conversation or discussion about certain art philosophies or phenomena in a multimedia-based program was also limited, because the users could only interact with some programmed information about these subjects. Thus, students could not have the same experience or equal level of information as when they discussed their artistic ideas or artwork with an instructor. In this case, the interactive multimedia-based teaching program could not function as the instructor in the classroom.

With this in mind, I did not create the IMI to evaluate students' work or discuss specific art philosophy with the user. The IMI was a straightforward teaching tool. It imparted multimedia lesson materials and asked users to take a quiz to test their knowledge at the end of a reading section. The interaction with the user was limited to giving information, navigation, and quizzes.

The Participants

Eight male and two female undergraduate students with various disciplines at The Ohio State University participated in evaluating the IMI CD-ROM. The age of the participants varied from 19 to 23 years old. Three
students majored in Industrial Design, one major in the Visual Communication, two majored in Computer Science, and two majored in Communication. One student had not decided her major yet. One student created his own major and called it Computer Animation because The Ohio State University does not offer this major.

All of them admitted to having a strong interest in learning about the theoretical and practical aspects of Western animation. Their animation and computer knowledge varied from elementary to advanced levels. The two elementary users had never taken animation courses and just started learning 2-D image processing software such as Adobe Photoshop and Painter. The five intermediate users have taken my animation courses in the past, knew several basic Macintosh 2-D and 3-D computer animation software, and had created one or two short animated films. Four advanced users were actively using advanced 3-D animation software such as Alias, 3D Max, LightWave, and SoftImage, and seriously plan to be professional animators.

The reason of choosing participants with various major backgrounds and levels of computer graphics knowledge was because I designed the IMI to be user-friendly so that all undergraduate students would have no problem in using it. Also, the participants' experiences would show whether or not their knowledge background affected their understanding in using the IMI.

My decision to choose these students was based on their interest in learning about Western animation and not strongly on their knowledge background or artistic ability. I did not choose the participants based on their gender type, race, or age, because I do not feel these specifications are relevant to my research. Based on my teaching experiences in computer graphics classes, both female and male students who have a strong interest in learning
achieved the same artistic and intellectual levels. From my conversations with my students and my own observations, I believed that motivation and interest are the strongest drives to improve students skills and broaden their knowledge base.

Seven out of ten users were my students in either Art Education 252, 352, or 595 courses. Based on their computer animation and still images, I realized that they were not extremely talented students, but they had enthusiasm for learning. When I told them about my animation projects, they were eager to participate. I also explained to them that the IMI project was not a computer game project, and that it was designed to help students to learn independently. The participants told me that they understood that the IMI was a serious learning tool and that it was not designed for entertainment. I let the students keep the IMI CD-ROM for one and a half to two weeks, depending how long they needed it. I gave each student a questionnaire to fill out once he/she explored the IMI.

The Interview

I arranged an appointment with each participant at the Emerging Technology Studio (ETS) in Hopkins Hall where the PowerMac 7200/120 computers were available. I demonstrated how to use the IMI CD-ROM for about ten to 15 minutes and asked each student to explore the CD. The participants did not ask many questions about using the CD. Instead they asked me about how the CD was produced. For instance, all of them asked: What was the concept of the project? Why did I choose to work on this project? What would I do with the CD after it was done? How did I design
the interactive layout? What software did I use to create IMI? Who are my committee members? How long did it take to finish the whole IMI design? I needed 30 to 60 minutes to answer and discuss these questions with each participant. After that, I gave them each a questionnaire and asked them to fill it out once they were done examining the IMI.

I gave one copy of the IMI CD-ROM to each student, asked the student to use it for two weeks, and then to make an appointment with me to discuss the experience of learning with the CD. Most students used the CD in the ETS computer lab, but those who have their own computers preferred to use it at home. I did not have any questions from the participants during the time they were using the CD. Eight out of ten students admitted that two weeks was enough for them to explore the CD thoroughly. One student explained that he did not have enough time because he was too busy trying to graduate that quarter. One student e-mailed me on the third day after he received the CD and told me that he finished reading and viewing all the learning materials in the CD.

The interviews were arranged in the ETS computer labs at Hopkins Hall and ACCAD. Each interview last for one and a half to two and a half hours. All participants' opinions were recorded. During the interview, the student and I sat in front of the computer and ran the IMI program. The student showed me how and where they explored and specified the sections that attracted their attention. By examining the way they used the IMI, I expected to find out whether or not the student really explored and understood the teaching program.
Questions of the Interview

The interview was arranged with each participant. The interview questions were basically similar to the questionnaire. They covered the presentation of the lesson material, navigation system, color and background composition, and quiz.

Here are the interview questions:

1. After learning with IMI, do you think your knowledge about the Western animation increased considerably?
2. Which one made you learn the most? The quiz, text, still images, film, or animation? Explain why.
3. What do you think about the amount of the reading material? Is it too much or little?
   Does reading make the learning process boring?
4. If I put in more animation and film clips, do you think you will be encouraged to learn more?
5. Are the reading materials understandable?
6. Which areas do you find most interesting? History, Pioneer, Technique, or Principles? Why?
7. Do you think the design interface supports the appearance of the teaching material well?
   Do you find any color or design that distracts your reading ability or makes your eyes sore?
8. Do you think the interactive system stimulates you to find out more information about a certain subject material?
9. Do you think the program presents a clear navigation system? Did you jump from one area to another a lot?
10. Do you think that the navigation system gives an easy access to all area in IMI?

11. Which navigation buttons help you the most in finding information? The pop-up map, Index, main-map, main-page buttons?

12. Do you think that the level of difficulty in the quizzes is reasonable?

13. Do you think the quizzes encourage you to read reading material more thoroughly?

14. Do you think the quizzes play an important part in your learning process?

15. Do you think that the Information button of each question in quizzes is helpful to find further material explanation?

16. Which quiz helped you learn the most? Jigsaw Puzzle, Matching Puzzle, or Multiple Choice?

17. Do you think it is necessary to put the Jigsaw Puzzle in?

18. Do you have any suggestion on how to improve the quiz presentation?

19. Do you think that the self-study mode is an efficient learning method for using IMI? Or would an instructor's assistance be more helpful to learn the material in the IMI?

20. Do you think IMI help you in appreciating the Western animation more? If it does, are you encouraged to learn more about it from other media or textbooks?

Based on their answers from the questionnaires, I created eight graphics (Figure 5.1 to Figure 5.8) to describe the participants' opinions about the presentation of the teaching materials, the navigation system, and the quizzes of the IMI. These graphics represent the participants' opinions about the presentation of the teaching materials, the navigation system, and the level of interactivity in the IMI.

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Questions of the Evaluation

The questionnaire and interview were designed to examine students' experiences and gain their input about learning with IMI. The main items to evaluate from the questionnaire were: (1) how could the IMI present appropriate assistance for the user in evaluating the lesson material?; and (2) how the student responded to the teaching material and quiz presentations.

There were five options in answering each question in the questionnaire: Strongly Agree, Agree, Uncertain, Disagree, and Strongly Disagree. The students checked only one option. The questionnaire asked the user's opinion about:

a. the clarity of interactive multimedia information (questions #2, #3, #4, #5, #6, #7)
b. the navigation systems (questions #8, #9)
c. the quizzes (questions #10, #11, #12, #13)
d. knowledge development (questions #1, #16)
e. self-study learning method (questions #14, #15)

The questionnaire is presented in Figure 5.1.

To collect more objective opinions from the users, I gave them another type of questionnaire. This questionnaire asked students' opinions about IMI in a straightforward way (Figure 5.2). To answer these questions, the user needed to try using all the aspects of IMI. This meant they needed to have some experience and understanding in working with the (1) interactive multimedia information presentation, (2) navigation system, (3) interface design, (4) quizzes, and (5) teaching material distribution.

Each question consisted of several sub items. To answer them, the user needed to be sure how the interface looked, what the navigation system was,
and how difficult the quizzes were. Since users might forget the structure or system of these aspects in the IMI, I advised them to fill out the questionnaire immediately after they were done exploring the IMI.

The next step after arranging the interview and collecting the questionnaires was improving the IMI based on the participants' inputs and experiences. I understood it was not possible to satisfy each user or to do all of their suggestions. As in classroom teaching, a teacher cannot fulfill students' expectations all of the time. I paid extra attention to suggestions that dealing with important aspects of the IMI such as the accessibility of each section, the clarity of the text, and the enrichment of the teaching materials. I also had to consider the time and energy required to make the changes. I could not make changes that needed a whole structural reprogramming of the IMI. To add just one new navigation icon, for instance, I would have to reconstruct the whole navigation system, scripting, and layout for each page of the IMI. This was not easy because the IMI contains more than 300 pages with specific Lingo scripting on each page. Because these pages are connected with each other, one change would directly affect other pages.

I tried to distinguish subjective and objective opinions to improve the IMI. Examples of subjective opinions were if a student preferred to have scroll down buttons rather than the arrow buttons to open the next page of the text; or if a student preferred to have the navigation buttons on the left side of the screen instead of the right side or even to open the text pages from right to left instead left to right. I considered these as subjective opinions and were not crucial issues because general participants did not find these issues disturbing or could not see them as problems. The benefits for making
subjective changes would not be proportional with the time and energy I had to provide to change them.

Examples of objectives opinions were if most participants thought that the background colors of texture of several sections of the IMI were disturbing. Or if most of them found out that it was hard to understand the navigation system in the IMI and they felt they got lost most of the time. For such important issues, I would have to changes the IMI regardless of the amount of time and energy required.
<table>
<thead>
<tr>
<th>#</th>
<th>Question:</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Uncertain</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>After learning with IMI, my knowledge about the Western animation increases considerably.</td>
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<tr>
<td>2.</td>
<td>Visual images in every article helps me understanding the material better.</td>
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<td>3.</td>
<td>Animation and film clips provide a clear explanation.</td>
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<td>4.</td>
<td>Combination of multimedia information presents a comprehensive explanation of subject material.</td>
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<tr>
<td>5.</td>
<td>The design interface supports the appearance of the teaching material well.</td>
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<td>6.</td>
<td>The interactive system stimulates me to find out more information about a certain subject material.</td>
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<td>7.</td>
<td>All presentation of multimedia information are always interesting.</td>
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<td>8.</td>
<td>The program presents a clear navigation system.</td>
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<tr>
<td>9.</td>
<td>The navigation system gives an easy access to all area in IMI.</td>
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<tr>
<td>10.</td>
<td>The level of difficulty in the quizzes was reasonable.</td>
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<td>11.</td>
<td>Multiple choice quizzes encourage me to read reading material more thoroughly.</td>
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<tr>
<td>12.</td>
<td>Matching quizzes encourage me to read the reading material more thoroughly.</td>
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<tr>
<td>13.</td>
<td>Information of each question in quizzes was helpful to find further material explanation.</td>
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<tr>
<td>14.</td>
<td>Self-study mode was an efficient learning method for using IMI.</td>
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<tr>
<td>15.</td>
<td>An instructor's assistance will be more helpful to learn the material in IMI.</td>
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<tr>
<td>16.</td>
<td>The IMI was very useful to teach appreciation of animation.</td>
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</tbody>
</table>

Table 4.1: questionnaire of the IMI presentation (1)
Please check (✓) on the most appropriate options:

<table>
<thead>
<tr>
<th>1. Interactive Multimedia</th>
<th>clear</th>
<th>unclear</th>
<th>accessible</th>
<th>inaccessible</th>
<th>useful</th>
<th>useless</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Articles</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>b. Images</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>c. Film clips</td>
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<td></td>
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</tbody>
</table>

Comments:

<table>
<thead>
<tr>
<th>2. Navigation System</th>
<th>clear</th>
<th>unclear</th>
<th>accessible</th>
<th>inaccessible</th>
<th>useful</th>
<th>useless</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Navigation buttons/</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>icons</td>
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<tr>
<td>b. 'Index'</td>
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<tr>
<td>c. 'Pop-up Map'</td>
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<td>d. 'Main Map area'</td>
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</tbody>
</table>

Comments:

<table>
<thead>
<tr>
<th>3. Quiz</th>
<th>clear</th>
<th>unclear</th>
<th>accessible</th>
<th>inaccessible</th>
<th>too difficult</th>
<th>too easy</th>
<th>reasonable</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Matching Quiz</td>
<td></td>
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<td>b. Multiple Choice</td>
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<td>c. Jigsaw Quiz</td>
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</tbody>
</table>

Comments:

Table 4.2: questionnaire of the IMI presentation (2)
### Table 4.2 continued

<table>
<thead>
<tr>
<th>4. Interface</th>
<th>distracting</th>
<th>undistracting</th>
<th>too complex</th>
<th>too simple</th>
<th>reasonable</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Color composition</td>
<td></td>
<td></td>
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<tr>
<td>b. Texture</td>
<td></td>
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<tr>
<td>c. Background decoration</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

**Comments:**

<table>
<thead>
<tr>
<th>5. Reading Material</th>
<th>clear</th>
<th>unclear</th>
<th>too much</th>
<th>too little</th>
<th>reasonable</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. History of Animation</td>
<td></td>
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<tr>
<td>b. Pioneers of Animation</td>
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<tr>
<td>c. Techniques of Animation</td>
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<tr>
<td>d. Principles of Animation</td>
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</tbody>
</table>

**Comments:**

Table 4.2: questionnaire of the IMI presentation (2)
CHAPTER 5

DATA ANALYSIS

This chapter contains data analysis of observations on how the IMI CD-ROM presents information about Western animation to the users. The data is gathered from formal and informal interviews with the users, direct observations during the operating process, written evaluation by the users, and questionnaires regarding the effectiveness of the IMI.

It is very difficult to understand this data analysis without using the IMI CD-ROM. The whole conversation and examination are based on the content of each section of the CD. I divided the technological evaluation into three factors: (1) Input and Output Capabilities, (2) Instructional Strategy, and (3) Interactivity.

Input and Output Capabilities

In this section, I evaluated two main aspects: (1) whether the lesson materials such as text, still images, film clips, and sound were presented
clearly and interestingly; and (2) whether the presentation of the teaching material was effective in describing a lesson.

The text played a major role in the IMI teaching material. I originally thought I should put more visual than textual information to make the learning material more exciting. However, due to the memory limitations and the extensive information that I presented in the IMI, I felt text became a very practical way to impart a large amount of information using relatively little computer memory. To discover the effectiveness of the text, I asked my participants about their feelings when they had to read the text in the IMI CD-ROM.

Jack Gordon

The first person that I interviewed was Jack Gordon, who majored in Communication. At the time that I interviewed him, he had just graduated with his bachelor degree. Because of his broad knowledge of Macintosh and Windows computers, he immediately got a job as a manager in the multimedia lab at the University Technology Services at The Ohio State University. Besides his technical computer knowledge, he also understood about the production of interactive multimedia design, computer animation, and Internet homepages. Based on his knowledge, I considered him an advanced computer user.

Gordon told me that compared to the other teaching materials in the IMI, he learned about Western animation mostly from the text. In places, he felt that there were too many pages of text, especially in the “History of Animation” section. He advised me to put a number for each page to help the user understand how long the text was going to be. Other than this, he
did not think that there was too much text in other sections, such as "Principles" and "Techniques of Animation." When I asked whether he thought that reading the text in the IMI made him bored, he explained that he did not think so because I put interesting color, still images, film clips and these balanced the amount of information and entertainment.

I asked him to pinpoint the most interesting sections in the IMI and he said, "I definitely like the History section the most because of the way it was written. It is very interesting, for instance, to see how all these studios began, how different animators, producers, and directors all worked together, switched, and formed their own studios." He said that he could understand my writing easily despite several incorrect spellings. He explained the still images and QuickTime film clips were very helpful in helping him to understand the text better. He did not think that I should put in more film clips but advised me that I should put more sound or music especially at the beginning of major sections. He told me that the music and animated film put at the beginning of the "Experimental Animation" section were fun to look at and that I should apply similar music and films at the beginning of other major sections. In his opinion, the IMI was too "quiet" and rather soundless as an interactive design.

Based on his opinion, I later added more music and animated films in front of each main area such as the "History," "Pioneers," "Techniques," and "Principles of Animation." The music and animated films really improved the appearance of the CD because they functioned as entertainment as well as information for the user that it was the beginning of a major, distinctive area.

Gordon explained that although the color and layout are attractive and well designed, some letters in several sections were unclear. When I asked
him to pinpoint the letters, he showed me the letters of the American Experimental animators names in the “Experimental Animation” section. He suggested that I should create more contrast between the colors of the names and the background colors.

Of the four major sections of the IMI, only the “Principles of Animation” section has little text and most of the learning materials are presented in animated films. Gordon said it was fun to see these films, but he already knew about these principles from when he took my animation course, Art Education 595. The films strengthened his memory and understandings about the animation principles, he added later. He was not as attracted to the animated films in the “Principles of Animation” section as to the text in the “History of Animation” because he learned something new in the latter section. From his explanation, I assumed that it did not really matter for Gordon if he had to read text from the computer screen to learn something new. Gordon’s opinion was supported by other participants such as Jack Miller’s.

**Jack Miller**

Miller was a junior majoring in industrial design, and he had no animation theoretical knowledge background. He was my student in Art Education 352. Miller knew of my CD-ROM project since 1995 because I sometimes worked on it during my open lab hours in the classroom. He showed a great interest in it and was willing to try it because of this. I let Jack used the IMI CD-ROM for about two weeks.

Miller did not think that there was too much text in the IMI. He expected to read more information about modern animated films such as
Aladdin and Beauty and the Beast. I explained to him that I stressed more on the importance of classical and experimental animation because of their contribution in the world of art and because most of them had been forgotten or ignored. For instance, people currently tend to associate animation with children’s interest or entertainment. This misunderstanding was caused by the lack of knowledge about the role and contribution of animation in society, education, and the Fine Art world. By observing the animated films from the past, the users would appreciate their existence and understand how these films influenced the development of modern animation.

Miller said that he was not bored or tired when he read the text because of the highlighted words linked to either still images or film clips. These words gave him a break in reading and the related pictures helped him understand the text better. As Jack Gordon, Miller also thought that the most interesting part of IMI was the “History of Animation” section because “...it shows the progression and how things came up.” Besides the “History of Animation,” Miller also liked the “Principles of Animation” the most. He told me that he enjoyed watching the “Staging” film clip that showed a chicken character on a dinner table.

As did Gordon, Miller said that most of the colors and layout designs were well presented. Nevertheless, he mentioned that the title and the background colors of the “MGM Animation Studio” section were a little bit blurry and hard to read. Other than that, he thought that the IMI design in general “look very professional.”

Miller was very nervous during the interview because he realized that his voice was recorded. He talked much more after the interview was done, and I disconnected the microphone from his shirt. He told me that before
using the IMI, he did not know about the important inventions and various
techniques in animation. He was encouraged to search for more information
and hoped to watch the complete versions of the film clips in the IMI.

Arnold Peterson

Unlike Jack Gordon and Jack Miller, Arnold Peterson did not feel that
reading text was appropriate in learning with an interactive multimedia.
Arnold Peterson was a senior majoring in Visual Communication. He had
been my student in Art Education 352 and Art Education 595 courses. I asked
Arnold to participate in my CD-ROM project because he admitted he had a
strong interest in animation, especially when it was related with computer
technology. He also wanted to learn how to organize an instructional
program by using authoring software.

Arnold said that reading from a computer screen was a tiring process
and he would rather read a book instead. He told me that I needed to know
people's expectation of having instant information from the computer world.
He also thought the color and layout design in the IMI were distracting and
too complicated. When asked to be specific, he told me that the background
should be plain and simple to avoid distraction. I asked him how I should
present the teaching material without presenting the text. He hesitated to
answer and asked himself how he could learn something without reading.

During the interview he admitted that he did not really explore the IMI
thoroughly. When asked why, he said that he was too busy trying to graduate
that quarter and he did not find it interesting to read the text in the IMI. I
asked him to show me which part he thought was distracting. He opened at
least seven different sections in the IMI and could not find what he meant.
He explained to me that the background color was pale with some stripes texture. I then knew which one he meant and directed him to the "Disney - World War II" section. He said that was the area that distracted him most.

In spite of the color background and the fact that he had to read, Arnold admitted that he did not have any problem in understanding the section with text because, "They are pretty well written." He also felt the film clips and the still images were very useful in improving the learning material. He suggested I add more film clips and should choose films closely related to the text. This suggestion was quite surprising to me because I would not choose film clips that had nothing to do with the teaching material. I asked him if he knew that there were more than forty film clips in the IMI. He was surprised when he heard this number and said that the film clips should be enough to impart information in the IMI.

Based on his opinion and the way he used the IMI, I could tell that he did not use the CD-ROM often. For instance, he did not know that there was at least one QuickTime movie in each part of the reading material. Nor did he know that he could find a list of all film clips by clicking the Index button.

Arnold was the only participant who thought that the background should be simple, like a plain sheet of paper. It was clear that he did not like to read from a computer screen. Arnold’s input was very important in suggesting changes to the IMI. I understood that not all students like to read. This helped me realize that I might have to add a reading voice or documentary films for the user in addition to the text. It would be better if the user could choose between read the text, hear the voice, or both. This, however, would have caused a data storage problem since sound and film files consume a lot of computer memory.
Arnold told me he already knew most of the teaching information in the IMI from my animation course that he took a year ago. He felt that the information in the IMI strengthened and refreshed his knowledge. By seeing some film clips, he felt encouraged to see full versions of the films.

I understood Arnold’s opinion that people only want to have instant information from computer technology. However, I have been working with computer technology for the last five years and, in my experience, the expected results did not always come instantly, even with the help of computer technology. They are many complicated working processes behind a complete, final result. Most of the time, the process of searching for information does not always happen instantaneously. By presenting the text as pages of paper in the IMI, I gave the users enough time and control to think, visualize, and let the information sink in their minds before going to the next material. Contrary to Arnold, my next participant, Bruce Reinhardt, enjoyed reading the text in IMI.

Bruce Reinhardt

Bruce Reinhardt was a senior majoring in fine art and photography. He was my student in the Art Education 252 and Art Education 352 in 1995. He was rather quiet but could be very open and funny once he felt comfortable. He never took a theoretical animation course. When I demonstrated my CD-ROM to him, Bruce showed a great deal of interest. He told me he would be happy to evaluate it and to learn more about theoretical aspects of animation.

Although Bruce thought there was a lot of information, especially in the “History of Animation,” he did not think that reading articles in the IMI
was boring. He felt this way because I inserted many still images and film clips in each article to kept his interest peaked. He said that he read each section several times because there was always a lot of information in it. He thought it would be too overwhelming to read a section just one time. The pictures and films gave a break from the reading process because the user would stop for a while before continuing to read on. I asked him whether I should add more film clips. In his opinion, the number of film clips in the IMI was enough to present clear examples.

Bruce felt that the "Principles of Animation" was the most interesting section. He said that it was easier to learn from this section than from the "History" section because each principle of animation was explained with one paragraph and an animated film. He explained this to me while opening each film clip in the "Principles" section. He laughed several times whenever he saw the 3-D animated films.

When asked whether he learned something from the IMI, he strongly agreed and added that, "After you read through all, you kind of have to learn something.” He later said that the IMI encouraged him to see more classic animated films, especially the ones that he had seen in the IMI.

In Bruce’s opinion, most of the color and layout compositions were not distracting and blended together. Bruce was the first person who mentioned that the the IMI design compositions appeared similar and were all in one tone. As a matter of fact, I intentionally arranged them to appear in harmony although each section had a different appearance. Beside Bruce, my next participant, Mark Jones, also mentioned the general appearance of the design.
Mark Jones

Mark was a junior majoring in communications. He had no theoretical animation knowledge background. Although Mark was not a former student, I knew of his strong interest in computer animation because he showed me many of his artworks, and we discussed them from time to time. He told me that he was interested in animation and would like to be an ACCAD student when he has completed his bachelor degree.

When I asked him to discuss the color background and layout design, he noticed that the IMI sections were presented in an analogous style and they appeared unified. He said, "... the backgrounds are so vivid, colorful, and interesting. But you also kept them so consistent for each part. . . . You kept everything in the same style and I think that really helps."

Mark explained he learned mostly from the text. He agreed that reading a lot of text would be boring, but did not see any other way I could present as much information other than through text. He did not think he would like to hear a voice reading the writing for him. The still images and film clips I inserted helped him to understand the reading material better. He said that if he compared the IMI with general scholarly textbooks, the IMI was much more interesting.

Mark mentioned he liked the history of experimental animation section the most because he never knew about this type of animation before. I was surprised to learn this because the "Experimental" section does not contain as many film clips and still images as any other sections. Because it was not as popular and profitable as commercial animation, there were not many experimental animated films and images.

The fact that several participants, such as Mark, enjoyed learning about
the "Experimental Animation" encouraged me to collect more data. I tried to contact Jane Aaron who is a prominent experimental animator who lives in New York. I found her address from Professor Terry Barrett, a faculty member of the Art Education Department, who once collaborated with her for a project funded by the Ohio Art Council. Professor Barrett told me that if I could reach Aaron, she might be able to help me contact other experimental animators. In my letter to her, I explained my doctoral research and told of my interest to use two of her films as examples. Unfortunately, she did not reply to my letter or phone call, so I assumed she did not want me to put her work in the IMI.

In spite of the limited quantity of the film clips and images, Mark found the "Experimental" section appealing and admitted he learned something new. When asked how the IMI helped him comprehend the animation world, Mark said that the IMI gave him a more thorough understanding concerning what happened from the past to modern days. He appreciated the classic animated films more than modern ones because he thought modern animators and film producers were concerned more about the production quantity than the quality. In his opinion, the quality of Western animation declined through the years.

Timothy Jackson

The other participant who found the "Experimental Animation" section interesting was Timothy Jackson. Because The Ohio State University does not offer the major that he was interested in, Timothy decided to create the major computer animation for himself. Timothy was my student in Art Education 252. He is a prolific and hardworking animator who uses 3D MAX
animation software to create 3-D animated films and plans to submit them for SIGGRAPH 97. He had some experience working with Alias and 3-D Macintosh software such as Strata and Infini-D. Based on his programming and artistic skills, I categorized him as an advanced computer animation user in my participant group. Despite his broad technical animation background, Timothy admitted that he did not know about the theoretical or historical aspects of animation.

Although I let him use the IMI for two weeks, Timothy e-mailed me on the third day after he received the CD and said that he was ready for the interview. He said that he read and reviewed all sections of the CD. I was quite surprised because he was the only participant who needed only three days to examine the entire content of the IMI. Timothy explained he used the CD continuously in the computer lab in Cuntz Hall where he worked as a student lab monitor. He only stopped whenever students needed his assistant.

Timothy was most interested in the “Experimental” sections because “…I knew nothing about it before. Everything that I knew so far is mainly commercial based. You always hear about Disney and Warner stuff, but never hear anything about independent, small time stuff.” Timothy later explained that he felt the same way when he read the “Pioneers of Animation” section. Although he admitted that he was not a person who liked to read, Timothy said that he continuously read the IMI because the content was interesting.

To find out whether Timothy really comprehended the reading materials, I asked him to go to any section or pinpoint any image or film clips while he was talking about them. For instance, when he told me that some of
the QuickTime movies in the IMI were too loud, I asked him to show me the exact movies. Timothy immediately went to the film clip presentations in the “Pioneers of Animation.” It was true that the film clips in this section were louder than the film clips in other section.

Another example was when I asked him about his favorite film clip. He quickly told me it was “Pas de Duex” by Norman McLaren because the motion and sound of the film were quite artistic. It was even more fascinating to him that this tedious and beautiful film was made with traditional techniques without using computer technology. The facts that Timothy noticed sound differences, answered questions correctly, and could go to the sections he mentioned convinced me that he had read all the teaching materials in just three days.

Timothy did not feel that the background colors and layout design of the IMI were disturbing. He said that some of them were rather “busy,” but he liked the “bright colors and flashy screen.” In his opinion, the IMI encouraged him to learn more about Western animation. He wanted to see the old animated films, especially the ones that were created by animation pioneers. Timothy has been serious about learning commercial traditional and computer animation techniques since he was a teenager. He did not know anything about nontraditional animated films that had existed before commercial animation. Based on his enthusiasm when talking about noncommercial animation, I felt that the IMI had opened his eyes to a different type of art.
Ching Shia

Not every participant felt the same way as Timothy about the "Pioneer" and "Experimental Animation" sections. My next participant, Ching Shia, was a freshman who had not decided her major yet. At the time when she participated in my research project, she was starting to learn about basic computer graphics in a course from the Art Education Department. Although she had no computer graphics and animation knowledge background, she conceded that she read many Disney and Warner Brothers cartoon books and would be happy to learn more about animation from the IMI.

During the interview, she explained that she visited all major sections of the IMI, but did not thoroughly explored the "Experimental Animation." She told me that reading the IMI did not broaden her knowledge because she had read most of the learning materials from other books. When I asked more specifically about her animation knowledge, she latter admitted that she did not know anything about the experimental and pioneers of animation. The fact that she did not know about these animations did not encourage her to explore them more fully. Because she could not give a clear explanation of why she chose certain sections and ignored others, I assumed that she would rather read or see things that she felt familiar with. In the evaluation form, she marked "strongly agree" that she learned a lot from the CD-ROM.

Shia described that the "Principles of Animation" as the most interesting section because of the way it was presented. I divided this section into six animation principles such as ease-in and ease-out, follow-through, anticipation, timing, squash and stretch, and staging. There is only a paragraph of explanation and a 3-D animated film for each principle. Besides
the "Quiz," the "Principles of Animation" contains the least reading materials in the IMI. By using straightforward information, I could show the application of each principle in an animated film effectively. Shia had never learned about these principles before. The fact that she could understand them easily indicated that this teaching method for this subject was efficient.

Ching Shia did not feel that reading the text in the IMI was boring because she wanted to learn anyway, although, she added, other users might feel differently. She said she enjoyed reading the text because it was obvious that I did some research before I put the information down. Beside this, she said, the still images and film clips made the text more inspiring because she could see examples of the work pointed out in the text. Like Timothy, Shia also specified that some QuickTime movies were too loud. She explained this by going to the QuickTime presentation and showing me which film clips she was talking about.

She did not think that the color composition and lay out backgrounds were disturbing. On another occasion, she asked me how to create the graphic design or script in the IMI. We discussed several image processing and authoring softwares because they were closely related to the teaching material of the computer graphics course that she was taking at that time.

When I asked her whether the IMI improved her understanding of the animation world, she said that learning about the history of animation helped her appreciate the animated films more because now she knew the complex production processes behind them. She said that she was not interested in seeing the complete version of the film clips in the IMI because then she would have to search for and rent them. I explained to her that she
could procure most of the experimental and commercial animated films in the IMI for free from the Columbus Public Library.

I felt that it was difficult to gain feedback from Shia because she answered most questions with "yes," "no," or a short sentence. For some reason she was not as talkative as when I talked with her on other occasions. This was perhaps because she was nervous because I recorded the conversation or she was afraid that I might find out that she did not know some part of the IMI very well.

**Denise Liu**

Denise Liu was a junior majoring in visual communication in Industrial Design. She took all of the computer graphics courses available in the Art Education and Industrial Design Departments. I knew her because she took my 3-D animation course, Art Education 352. Because she had a strong interest in creating animation, I asked her to participate in my research. As most participants, Denise did not really know about the theoretical and historical aspects of animation.

Denise admitted that she was more of a visual than a textual person. Nevertheless, she did not feel bored reading the text in the IMI because of the way I summarized the reading material that enabled her to find all important points easily. Besides this, she added that she could understand my writing easily, although English is not her mother tongue. In her opinion, the length of the film clips were sufficient in explaining the teaching material. She felt that I should not make the film clips longer than eight to ten seconds because they explained particular things well enough in that amount of time.

Based on my teaching experience in my animation course, I believed
that it would be more effective to show a little part of a film to impart important information. For instance, before I explained about staging in animation, most of my students only presented a direct, frontal camera position. They always showed every scene in one point of view and rarely changed it, even for dramatic scenes. To show the importance of staging, I edited and showed them the beginning of "The Right Stuff" film in the classroom. This short part of the film shows that the hero was a test pilot who faced a dangerous mission flying a new airplane. One of his friends who tried to fly this airplane was killed. All information was presented without any dialog, but the audience had no trouble following the story. This was because the director demonstrated such efficient stage compositions that just by seeing the scene and listening to the music the audience could understand the film completely. After they watched this example, my students were encouraged to do more experiments with the aspects of staging in their work.

Unfortunately, I could not see this kind of improvement in my participants' animation after they used the IMI. They did not immediately create animated films after using the IMI. It usually takes a lot of time and effort to create a serious animation. The IMI was not designed to analyze the user's artwork. It only could give general information, provide access for the user to choose any information needed, and provide a quiz to test the user's knowledge.

As did most participants, Denise found that the "Principles of Animation" was the most interesting section. She felt she could comprehend the animation principles instantly because of the animated films I provided in this section. She had no complaints about the color background or layout
composition. She liked the colors in general because they appeared as natural colors and blended together.

Denise expressed that she was thoroughly satisfied with the IMI. I tried to ask her the same questions on several different occasions to find out if she actually had some criticisms or advice on how to improve the IMI. For instance, I asked her several times about the amount of the reading materials, or the way I presented the readings in the IMI. She consistently gave me the same positive answers and did not make any further suggestions. At the end of interview, she told me that she would definitely buy the CD if I could market it in the future.

Patrick Stevenson

Patrick Stevenson was a sophomore majoring in computer science. He realized that he was more interested in creating artistic films than programming and planned to switch majors to Fine Art. I knew Patrick from a friend who taught him in Art Education 352 course. In her opinion, Patrick was a mature and diligent student with strong artistic skills. After showing my CD-ROM to him, Patrick was immediately enthusiastic about using it.

Patrick was the only person who showed the CD to others and let someone else, his father, use it. He told me that his father was an art teacher in a high school. Perhaps this is the reason why his father found the contents of IMI interesting. Patrick told me that although his father had no computer knowledge background, he understood the navigation system and enjoyed reading information about the "Principles" and "Techniques of Animation."

Patrick admitted that he did not really like to read and preferred to watch visual information. That was why he felt he learned most from seeing
the still images and film clips. They also broke the reading cycle for a while
and gave Patrick a break between readings. He said that he tried to read the
text as much as he could, but he could only take a small dose of it at a time.
When I asked him if he thought that there was too much text, he said
sometimes there was, but in general, the amount of text was "pretty
reasonable." He mentioned that he really liked the "Pioneers of Animation"
section and did not think that there was too much reading material in this
section.

I asked Patrick whether he preferred to have some voice reading the
text for him. He was a little bit hesitant to answer and stressed again that he
did not really have a serious problem with the text length. He added that it
would be neat if he could have the text read for him. He said, "Perhaps just
kind of a slide show through it and have somebody read it in the background
and just see the images. Perhaps that would be nice for someone who didn't
want to go through it and read it or for someone who would like to learn it in
other way."

Patrick did not think that I should add more QuickTime movie files
because a lot of people have a tendency to just watch the film clips. He
confessed that he many times skipped the reading material to find the
QuickTime movies and watched them. This is because, he added, the film
clips were fun to watch. He commented that it was good when the user did
not know whether or not there would be film clips on certain pages. Because
when the user knew it, then there would be a strong tendency to see the film
only without really reading the text. Patrick said that the movie clips gave
people reason to explore more.

I was amazed with Patrick's discussion because it revealed the exact
reason why I did not mention where I put the film clips in the text. It was true that the user could always see all the film clips by using the index button, but I provided this button to help the user keep track of how many films they had seen or which particular film they planned to see after reading the text. In my opinion, it is important that the user be willing to spend some time reading because the text is the essence of the IMI teaching materials. The still images and film clips can make the text more interesting, but they also function as rewards whenever the user was willing to scan or read the text.

Patrick said that he really liked the designs for the background and layout. In his opinion, the background images were interesting just by themselves. He did not think that the color or object composition was distracting.

In Patrick’s opinion, the most interesting section of the IMI was the “Principles of Animation.” He explained the reason was because “… they are fun to watch, kind of short, and sweet. … I did not have to figure out much with it. Just saw what it was to understand it.”

When I asked him whether the IMI encouraged him to learn more about animation, he said that it did. The CD content introduced him to pioneers of animation and he learned to respect their work. He wanted to go out and investigate more information concerning the things he read about in the IMI. He thought that they were pretty interesting. He said that he would especially like to understand more about the principles of animation.

Mark Simmons

Unlike Patrick, my next participant, Mark Simmons, thought that the “History of Animation” was the most interesting part of the IMI. Mark said
that he already interested in the history of animation a long time before he used the IMI.

Mark was a junior student majoring in computer science. He was my former student in the Art Education 352 course. He told me he felt happy that I asked him to participate in my research because he felt this was a rare opportunity. As with Patrick, Mark was also generous in giving me information about his experience in using the IMI, especially after the interview was over.

As a person who likes to read, Mark found reading the text in the CD interesting. The reading process was not boring because he could see still images and film clips. He said the only problem was it was not really comfortable and could be tiring to read the text through a computer screen.

Mark explained that actually he did not read the text or use the index button to access the film clips. Instead he used the Movie Player software in the hard drive and opened QuickTime movie files from the CD to make sure that he saw them all.

Occasionally, Mark felt that the color of some index buttons was too vague. I asked him to show me which buttons he was talking about. He went to the “Experimental Animation” and pointed out the animator’s names buttons. He said that the words did not appear clear enough, but the colors became clear when he rolled the cursor on top of the names. I explained to him that I scripted a roll-over function in Lingo to change the colors. I intentionally chose analogous colors for the buttons and then showed more contrast colors when the user tried to click on these buttons. Because Mark was the second person after Jack Gordon who mentioned about these vague
colors, I felt that I should change the colors of these buttons to make them stronger.

Mark felt that the IMI was very useful for learning about animation in general. He said that he looked forward to taking my Animation Project course (Art Education 595) in 1996, but, unfortunately, the course was canceled and has never been offered since then. I explained to him that he could learn most about the teaching materials from my class in the IMI CD-ROM without attending the class. The only teaching activities that I could not present in the CD were the class critiques, artistic evaluation of the student's work, class discussions, sharing opinions, and all aspects that need human interactions.

Summary of the Input and Output Capabilities

In the IMI, I organized the teaching materials in three different levels: (1) writing or text as the main teaching materials, (2) visual images and film clips to support the text, and (3) as part of the films. I presented all materials in colorful displays, dynamic design compositions, with some musical background. No section looked exactly the same. Each major section had its own opening, animated films, and music. The purpose of doing this was to make the whole presentation appealing and entertaining.

Nine out of ten participants said that reading the text in the IMI CD-ROM was not boring nor did it discourage them from further learning. Some thought that the writing was interesting, easily understood, and kept them reading further. The fact that I put many still images and film clips on almost every page of the text was very useful in maintaining the user's learning.
attention, providing a break during reading, and making the text more inspiring.

Based on my participants' inputs, I added a page numbers in the newest version of IMI. These numbers were important to help the user understand how long a text section was going to be and on which page he/she was. To provide additional information about the navigation icons functions, I created a help button at the beginning of IMI. When the user clicks on this button, the computer will reveal a page informing about the function of each of the navigation icons.

Nine out of ten students enjoyed the layout design and color composition. Most of them said that in general they looked fine, although some color background in certain sections looked either too sharp or too pale. I tried to change the distracting colors as much as possible, but this did not always solve the problem. Sometimes a computer monitor displayed the colors in slightly different tones than others. So, the user might need to adjust the brightness and darkness of the computer screen to have a better display.

All participants agreed that IMI broadened their knowledge concerning Western animation. Nine out of ten said that the teaching material made them appreciate the production and creative process of animated films. Most users, especially the ones who did not take the Animation Project course, had no prior knowledge about the pioneers and experimental animation. Five (Jack Gordon, Timothy Jackson, Jack Miller, Patrick Stevenson, and Mark Jones) out of ten students admitted that they really appreciated the achievements of independent animators and would like to know more about them and see complete version of the film clips.
All participants thought that the "Principles of Animation" section was fun and easy to understand. However, only Ching Shia, Denise Liu, Bruce Reinhardt, and Patrick Stevenson chose it as their favorite section. Three students, Jack Gordon, Jack Miller, and Mark Simmons, preferred the "History of Animation" as the most interesting section. Timothy Jackson appreciated the "Experimental" and "Pioneers of Animation" most.

I did not think that their strong interest in some sections was based on their animation or artistic knowledge background because some advanced users liked the same sections as the elementary and intermediate users. Also, intermediate users such as Mark Jones and Jack Miller showed strong interest in the history and experimental animation as did the advanced users Jack Gordon, Mark Simmons, and Timothy Jackson.

All participants filled out questionnaires regarding their experience after using the IMI. The copies of their answers can be seen in Appendix A. The graphics in Figure 5.1 to Figure 5.4 describe the participants' review of the way I presented the information. Examples of the questionnaires can be seen in Table 4.1 and Table 4.2.

The questionnaire results and interviews show positive results concerning the purpose and effectivity of the IMI in imparting teaching information clearly. The text, still images, film clips, and sound functioned well. Most participants did not feel confused or discouraged by learning from the IMI. All participants believed the teaching program helped them appreciate the work of Western animation.
Figure 5.1: questionnaire results of the teaching material presentation
Question A: After learning with IMI, my knowledge about Western animation increases considerably.

Question B: Visual images in every article helps me understanding the material better.

Question C: Animation and film clips provide a clear explanation.

Question D: Combination of multimedia information presents a comprehensive explanation of subject material.

Question E: The design interface supports the appearance of the teaching material well.

Question F: The interactive system stimulates me to find out more information about a certain subject material.

Question G: All presentation of multimedia information are always interesting.
Information:

- = clear
- = useful
- = accessible
- = unclear

Figure 5.2: questionnaire results of the interactive multimedia presentation
Figure 5.3: questionnaire results of the interface design presentation
Figure 5.4: questionnaire results of the reading material presentation
**Instructional Strategy**

In this section, I evaluated two main aspects: (1) whether the navigation buttons present appropriate assistance for the user in accessing the lesson material; and (2) whether the quiz was effective to analyze the user's knowledge. The IMI had ten main navigation buttons (see Figure 3.1).

I designed three types of quizzes, "Matching Puzzle," "Jigsaw Puzzle," and "Multiple Choice." I provided a link on every last page of text to the quiz area. The user could click the "YES" button to go to the quiz area and "NO" to turn it down. I did not provide any other link to the quiz location. Later in the IMI final version of the CD, I decided to create a link button in "Main Map" location to the quiz area. This change was based on the participants' input.

**Jack Gordon**

Jack Gordon explained that without a quiz link in "Main Map" section, the user might not know there was a quiz available. He knew there was a quiz section in IMI, because I demonstrated it to him before he kept the CD for two weeks. But he soon forgot where this section was or how to get there. He was frustrated and spent more than five minutes before he finally found it. He told me that although he read most of the IMI text, many times he did not read up to the last page, on which the question about going to the quiz area would appear.

I explained to Gordon that the quiz could also function as entertainment or a game because of the way I designed it. Therefore, I could also treat it as a present for the users whenever they reached the last page of
the text. Gordon then said, "But what if the users jumps around all the time and never reaches the end of the text?" He later added that these users could spend a whole lot of time using the CD without even realizing there was a quiz.

Other than his hard time finding the quiz, Gordon admitted that he never felt lost no matter where he was. This, he added, was because he always used the "Main Map" area to go anywhere or to move to a different section. He also thought that the "Pop-Up Map" button was great and useful. The only problem was that non-computer user might be confused what the icons of the "Main Map," "Pop-Up Map," "Index," and "References" buttons stood for. He advised me to put a roll-over text beside these icons. He then continued, "The other idea is to put a link button to a key page in the homepage. This key page briefly explains the whole navigation icons. But I think the whole navigation system works pretty well."

I agreed with Gordon's opinion about adding information for the four navigation buttons. But to put roll-over text in the entire design would change entire navigation system of the IMI. There are about more than 300 pages in the IMI and each page presents these four buttons with their specific Lingo script. To do this would mean that I would have to change the whole scripts more than a thousand times just to add roll-over text in the IMI design. A more practical solution was Gordon's idea about creating a key page in the homepage. In additional to this, I printed out the functions of all navigation buttons in the CD cover.

The fact that Gordon was able to jump from one area to another without ever feeling lost showed the effectiveness of the "Main Map" button. The "Pop-Up Map" button had a similar function to the "Main Map" but
without providing links to other areas. The buttons were crucial for accessibility in my teaching design.

Jack felt that he learned the most from the “Matching Puzzle” of the three types of quizzes. He chose it as his favorite quiz because it was more visual than others. He liked it because he could see various types of animation characters and devices. He thought that the “Multiple Choice” was harder because they were mainly text.

Gordon agreed that the “Information” button in each quiz page was useful to give him a clue. He added that it would be even better if by clicking this button, he could just go directly to the exact page in the writing that contains the correct answer.

I asked Gordon the way he found the correct answer for each question in “Multiple Choice.” He admitted that whenever he could not answer correctly, he did not search for information in the writing, instead he would either press other buttons until he eliminated all the wrong buttons or until he found the right one. But even so, he said he could still find the information for correct answers. And this meant, he added, he could “still pick something up.”

Although he believed that the “Multiple Choice” and “Matching Puzzle” were useful, he did not feel the same way about the “Jigsaw Puzzle.” Gordon thought the puzzle was for fun only and it should not be in the quiz section. However, he commented that he had a good time playing with it. The only problem was the border page was too small and he had a hard time finding small puzzle pieces.

Gordon believed that his computer knowledge background was useful in examining the IMI accurately. He said his experiences in using various
CD-ROM and computer games enabled him to give me advice to improve the IMI. He also thought that he learned about designing a complex links navigation from my CD.

Jack Miller

As with Gordon, Jack Miller also felt that his computer knowledge background helped him evaluate my teaching program. He said he understood some of the basic concepts in computer animation from the classes he took. Because of this, he could better appreciate and understand the work of pioneers in animation on the CD.

Like Gordon, Miller also pointed out the importance of giving roll-over text for "Main Map," "Pop-Up Map," "Index," and "References" navigation buttons. In the evaluation form, he wrote that I should refer to the example from Microsoft Word software. When Miller mentioned this roll-over text, there were only one or two popular software package using this function. But currently, it could be found in almost all popular software such as Adobe Photoshop, Macromedia Director, and Netscape Navigator.

Miller had the same opinion as Gordon in that I should put a clear quiz link in the "Main Map" area. From all of the navigation buttons in the IMI, Miller thought that the "Main Map" was the most helpful.

When asked whether the quiz was useful, Miller explained that the quizzes helped him to go back and read information that he might otherwise skip over. Unlike Gordon, whenever he answered a question incorrectly, Miller would return to the reading material and read the text more carefully until he got the correct explanation. He thought that "Multiple Choice"
quizzes were very useful to brush up his memory and he felt comfortable with this type of quiz.

Arnold Peterson

Arnold Peterson, believed that "Matching Puzzle" and "Multiple Choice" were useful in helping him to learn more. But, he said, the "Matching Puzzle" was ambiguous because of the way the user found the correct answer. He said, "For instance, if you drag an image inside a correct box, then you hear a voice say 'Good Job.' But if you drag it incorrectly, you don't hear anything. I think you should put some warning voice if the user drags an image incorrectly. But as far as for learning, I do think that the quizzes help to put things together."

I strongly agreed with Arnold about providing additional voice to warn the user that they dragged the image to a wrong box. Due to my extremely limited programming ability, I had a hard time in writing an appropriate program in Lingo. I tried to ask a more knowledgeable Director user to help me out with this, but to no avail. I might be able to script better in the next version of IMI or whenever I get a chance to rework it.

Arnold did not think that the quizzes were too hard because he could always find some clue in the "Information" button. However, Arnold did not use this button to search the correct answer in the reading material. Instead, he admitted, he tried to press all answer buttons until he found the right answer or dragged the image to the boxes until he heard the "Good Job" response.

When asked about the effectiveness of the navigation button, Arnold thought that the "Next Page" and "Previous Page" buttons were most useful.
At the beginning, he flowed from one section to another by using these buttons. But once he found out about the "Main Map" button, he admitted that he jumped to many sections. Arnold explained that he did not find the "Pop-Up Map" button really useful because he believed he was an experienced computer person and was not afraid of getting lost by going to any section. Perhaps, he added, a non-computer user might find it more helpful.

Arnold thought that his computer graphics and art knowledge helped to understanding my CD-ROM. He explained that he knew about the basic "rules" or techniques for creating multimedia presentations, and therefore might have known what to expect in terms of navigation and layout.

**Bruce Reinhardt**

Bruce Reinhardt believed that the navigation buttons were well designed. He wished that the "References" button would not disappear whenever the user stopped pressing the button because this made it hard to write the references down. I told him that he could see the bibliography list by pressing the "Index" button. This button would take the user to the "Index," "Film List," and "Bibliography" sections.

When I asked him whether he ever felt lost in exploring the IMI, he said never. He did not jump around all the time although he knew he could do so by using the "Main Map" button. Rather he followed the arrow buttons most of the time. He only used the "Main Map" button whenever he had to go to a different section. He thought it was "neat" that he could access all area quickly with this button.

Bruce believed that the level of difficulty of the quiz was reasonable.
He added that I designed the quiz in a clear and straightforward manner. He said that if he read carefully, then the quiz was not that hard. When asked whether he thought the quiz was important, he said, “Yes, I think the quiz works as a reminder of things you forgot from the text. It highlights important information of the text.”

Bruce thought that the “Multiple Choice” and “Matching Puzzle” were most useful from the quiz section. If he could not answer the question correctly, he would either choose other buttons or he searched the reading materials until he could find the right answer.

I asked him if his computer and art knowledge background were useful in using the IMI. He said that he believed so because he had an interest in the animation subject matter from what he learned from his major. He then could relate and had fun with the animation examples given in the CD.

Timothy Jackson

As Bruce, Timothy Jackson also believe that his art and computer knowledge background helped him evaluate the CD better. He told me that his understanding about animation technique carried over into the lessons.

Timothy said that he did not primarily learn from the quiz, but from the text instead. The quiz, he continued, played as an afterthought. He picked up the most information from reading and learned, again, from the quiz. He believed that the quiz should be included in the IMI because it worked as recaps of what you learned. He said, “It doesn’t really seem like a real test. It is more like a review.” However, Timothy thought that the quizzes, especially the “Matching Puzzle” were too easy for college level, but not for
general users. He felt as long as he paid attention to the reading, he could answer the question easily.

He described that the “Matching Puzzle” was the best for him because he could see two lists where you can compare two different animation elements. The “Multiple Choice” was more like a real test that he could find in a class. He thought that the “Jigsaw Puzzle” was more like fun. The only problem with the “Jigsaw” was he kept loosing small puzzle pieces because the border screen was too small.

I asked Timothy if he used the “Information” button in the quiz to find a correct answer. He said he did not because he felt it did not really matter for him if he answered it incorrectly. He just tried pressing other buttons until he got the correct answer. He said, “If I got it wrong, I got it wrong. If I got it right, I was happy.”

Timothy felt that I organized the navigation system very well because it was very easy to get around. He described that even when he was deep into a section and wanted to go back to find a new section at the beginning all he had to do was just click the “First Page” and “Previous Page” buttons and then he was there. He never felt that he got lost or had to use the “Pop-Up Map” button because he always knew where he was.

Denise Liu

As with Timothy, Denise also agreed that the navigation system worked well. She found the “Main Map” button most useful because she could jump to any section she wanted quickly. As with other users who were satisfied with this button, Denise also did not use the “Pop-Up Map” or ‘Index’ buttons often because she already knew where she was. She said, “[T]
he "Main Map" button is enough for the navigation." When I asked her if it took her a long time to understand the navigation buttons, she said no and then quickly enumerated the function of all ten main navigation buttons.

Unlike the majority of participants who believed they learned mostly from the reading, Denise choose the quiz. She said that the quiz was really great, especially the "Jigsaw Puzzle" and "Matching Puzzle." She added that the "Multiple Choice" was more like a regular quiz. She told me that it was fun to do the quiz and she "loved it." When I asked her if she thought the quiz played an important role in the CD, she answered yes because it helped to pull things together and helped her remember information.

Whenever Denise did not answer the quiz question correctly, she did not return to the reading to find the answer. She would rather try other buttons or drag the image to other boxes until she found the answer. Although she knew there was an "Information" button, she did not use it frequently.

Denise thought that her computer graphics and art knowledge helped her in understanding my CD-ROM. She explained that she could examine the way I organized the graphic design for all teaching material. She did not feel tired or bored to examine various types because of the neutral colors, interesting reading, film clips, and still images. In general, Denise said that the CD-ROM helped her to know about Western animation.

**Ching Shia**

While Denise liked the quiz very much, Ching Shia did not. She did not feel that the quiz played an important role because, she would read the text anyway, even without the quiz. I asked her whether it would be fine if I
got rid of the quiz then. She answered, "Yes . . . well, not really. It is just to prove that I knew what I read." She never used the "Information" button in the quiz because she did not feel she needed a clue to find the answer. The other reason was because she was afraid that she could not find the quiz area again once she left it. Among the three types of quiz in IMI, she thought that "Multiple Choice" definitely helped her learn the most.

Ching Shia said that she had no problems in using the navigation buttons. She used the "Main Map" button to pick a section and went through all parts of the section until it was finished. Then she would pick a new section and went through all of it until she saw everything. I thought that was a systematic way to examine the IMI content. She said that she did not know that there was a "Pop-Up Map" button on almost every page. The fact that she never used it without getting lost showed that the "Main Map" button was enough to guide her around. She did not think that the "Index" button was necessary for her to find film clips. This was because, she added, she did not use the IMI just to see the film and would rather find it in the reading.

I asked Ching Shia if she felt her computer graphics and art background were helpful in examining the IMI. She said, "It helped me be more forgiving of tiny mistakes and it made me appreciate the effort in making such an in-depth production."

Ching Shia was not the only participant who did not really care about the quiz. I could tell that Mark Jones felt the same way, although he did not say it. This was because Mark did not explore the quizzes. He told me it was fun to see the "Jigsaw Puzzle" but he was reluctant to play around with it more because he might lose small quiz pieces. He was not encouraged to use
the "Matching Puzzle" at all. Despite of these facts, he admitted that he might have learned something from the quizzes, other than from the readings. I asked him if he thought the quiz encouraged him to read the text more thoroughly. He said it was nice to have it at the end of every text, so the users could test how much they knew.

I was aware of the possibility that some users might not like taking quizzes at all. This was why I put the "Jigsaw Puzzle" as part of the quiz. The "Jigsaw" mainly function as entertainment, but it could remind the user about important characters of famous animated films. Therefore, I always put the animator's name, work title, production year of the film in the "Information" button. Despite my effort, some users might not feel interested in taking the quiz just because they did not like the idea of being tested.

I found this out when I exhibited my CD at the Bexley University during Winter Quarter 1997 in Bexley county, near Columbus, Ohio. I saw about five to seven undergraduate students playing with my CD. They seemed to like the film clips. After they played for about five minutes, they ended up in the page that asked whether they wanted to take a quiz. The person who held the mouse was reluctant. His friends laughed and said, "Oh no, not another quiz." I assumed they might have taken some quiz in their class before they came to the exhibition. One female student replied, "Just press the "NO" button. Quiz is the last thing I need on Friday." The whole group agreed with her, and the user went to another section.

But this situation might not happen with other groups of people who like to challenge their knowledge. I realized this when I was working in my apartment in Troy, Michigan, when two husband-and-wife couples came to
visit us. The two men had engineering and physics backgrounds. The women had art education and mathematics education backgrounds. When they saw the quiz in the IMI, they were eager to answer it. None of them had computer graphics or animation background, but they liked animation when they were younger and this showed. For instance, in the “Matching Puzzle,” there was a task that you had to put the Pink Panther character in the correct box that had the name of its animator. One person knew that Pink Panther had a French accent so she immediately dragged the Pink Panther character to the box that had a French name in it, DePatie-Freleng. She was happy when she found out that she was right. Then the whole group tried another question. This was very interesting for me, because I did not expect adults to be interested in taking the quiz.

Patrick Stevenson

Patrick Stevenson explained to me that he also liked to take the quizzes. After trying all three types of quizzes, he liked the “Matching Puzzle” the most. He found the “Multiple Choice” harder than “Matching Puzzle” because it was more specific. He liked the fact that he could find the answer in the reading by using the “Information” button.

In Patrick’s opinion, the “Jigsaw Puzzle” was rather challenging. He was not sure whether he learned something from it, but he was certain that it was a lot of fun.

When I asked him if the quiz was important for the learning process, he thought it was. He explained that many times the user learned many things that he/she missed by not being asked about it. This stressed the important function of the quiz. He said, “If you were asked about it and you
got it wrong, then you will find out what is the right answer.” Based on this, he felt that I should include the quiz as part of the IMI.

In Patrick’s opinion, the navigation system of the IMI was well constructed and appeared constant throughout the entire design. He explained that wherever he went, the navigation buttons were constantly available and had the same appearance. He added, when the forms or position of the buttons changed around a lot, he could not easily understand what each button was for. It took him a little while to get used with the “Main Map,” “Pop-Up Map,” and “Index” buttons. He did not find any problem with the “Main Menu,” “Next Page,” “Previous Page,” “Previous Section,” “Next Section,” “References,” and “Quit” buttons because they were self-explanatory.

The only time he felt rather lost was when he picked up some film from the “Film List” section. He explained to me that after clicking a film title, for instance “Rooty-Toot-Toot,” the computer screen revealed the film. After seeing the film, he clicked the ‘Previous Page’ button, expecting to return to the “Film List” section. But instead of going back to the “Film List,” he was taken back to the reading area in the “United Production of America” section. This unanticipated area broke the flow of where he was going and he felt he was dropped into an unexpected place. He then pressed the “First Page” button to take him to the beginning of this section.

Patrick explained that although he was happy with the fact that he could jump to any section with the “Main Map” button, he tried to stay as much with the flow without jumping around too much. He said that the reason was because, “. . . I want to go through it sequentially. And at the other
time, I kind of went back and took a look at stuff that I thought neat. I like to
take a look at it over.”

Patrick admitted that he did not use the “References” button too often.
He only used it just to see the form of the scroll object because the thought it
was “neat looking.”

I felt Patrick was very generous in giving information. He did not
answer my question with “yes” or “no” only, but he took time to explain his
opinion thoroughly. As a computer science student who had a strong interest
in artistic animation, he knew the concept and process of creating an
interactive multimedia teaching design. The fact that he examined the IMI
thoroughly enabled him to give important inputs to improve my design.

Mark Simmons

Mark Simmons felt that the text and the quiz were the most important
part in his learning. He said that usually after he read the article, he would
take the quiz. Whenever he could not answer the questions correctly, he
would return to the reading again until he could find the answers. He felt
confused sometimes when facing questions that he had not read before. For
instance, after reading a “Experimental Animation” section, he would take
the “Matching Puzzle” of the “History of Animation.” In this quiz section, he
faced questions about “Disney,” or “Television Animation” that he had not
yet read before. He thought that the quiz would only ask about the reading he
just read and he might have pressed a wrong button.

My explanation to Mark was that I divided the quiz based on the three
major sections such as the “History,” “Pioneers,” and “Techniques of
Animation.” The “Experimental Animation” was located under the “History
of Animation" section. If the user went to the quiz after reading the
"Experimental Animation," he/she would face questions about everything in
the "History" section. I did not create a specific quiz for minor sections.

As most participants, Mark felt that the navigation system in the IMI
was well organized. He did not have any difficulty in using the buttons
because he thought that they were self-explanatory. At the beginning, he tried
to follow the sequential flow, but not after he knew he could jump around
with the "Main Map" button.

Mark also felt that his computer science background enabled him to
better examine my design. We talked about my CD much more after the
interview was over. I thought he felt a little bit nervous during the interview
because he was being tape recorded. Mark gave me a lot of suggestion about
improving the hard drive and taking care of the data storage problems.
Unfortunately, it was costly to increase my hard drive and memory capacity.
Nevertheless, I was happy with all my participants' input to improve my IMI
teaching design.

Summary of the Instructional Strategy

The participants did not find any serious navigational problems in
dealing with the IMI design. This meant that they could access all areas in the
IMI quickly. All students used the "Main Map" button frequently to go to
various sections. All users explained that they never felt lost when they went
through the reading materials. One user said he only felt lost when he went
to see the film clip from the "Film List" section. But then he could find
where he was quickly by going to the first page of the area where he was.

The "Main Menu," "Pop-Up Map," "Index," and "References" buttons
were not used as much as the "Next Page," "Previous Page," "First Page," "Last Page," and "Main Map" button. Usually, users who felt comfortable with the "Main Map" button did not feel they needed the "Pop-Up Map" button to show where they were. Four students mentioned that it would be better to provide separate information about the "Main Map," "Pop-Up Map," "Index," and "References" buttons. Other buttons were self-explanatory and I did not have to add information.

All students admitted that they began without specific things in mind to learn before using the IMI. When they first opened the IMI, I directed them to learn either the history, pioneers, techniques, or principles of animation. Once they were inside the teaching program, they would start to explore. Most students admitted that at the beginning, they tried to follow the sequential links continuously. But once they found out about the "Main Map" button, they started exploring much more. Three students admitted that they preferred following the links until they opened pages in a section before going to another section. Only five students explored the area they were interested in and did not examine uninteresting sections. Five students admitted that they read all reading material indiscriminately.

Based on these facts, I assumed that at the beginning, most users were freedom users. They did not have a plan or expectation of what knowledge they wanted to know. Once they decided to pay attention and study from the lesson material thoroughly, they then became structural users. When later they decided to take the quiz, they would choose the quiz that asked about knowledge they had learned in the reading. The next time when they used the IMI again, they would either go to the same lesson material and read it again until it was over or go to explore a new section. After they knew what
to expect and how to access it, they became explorer users. The explorer users were just like a tourist who, before visiting a country, had already planned what to buy, where to go, and what to gain. None of the participants ever mentioned looking at the "Bibliography" section. Nevertheless, I believed that this section would be useful for those who needed animation resources.

All student tried the quizzes in various levels. Jack Gordon, Jack Miller, Denise, Patrick Stevenson, Mark Simmons, Timothy Jackson, and Bruce Reinhardt admitted that they tried all three types of quizzes and used them as often as they could. Three other users, Ching Shia, Arnold Peterson, and Mark Jones, were not as interested in the quizzes. Nevertheless, they all believed that the quiz played an important part in the IMI design.

Because of the way I designed the quizzes, most users did not find the quizzes too difficult. Three participants mentioned that the border screen of the "Jigsaw Puzzle" was too small and they kept losing small quiz pieces. All users thought the "Jigsaw Puzzle" was for fun only and did not help make them learn a lot. Eight users explained they had fun playing with this puzzle.

Five participants, Jack Miller, Jack Gordon, Patrick Stevenson, Bruce Reinhardt, Arnold Peterson, told me that the "Information" button on each page of the quiz was quite handy. They said that the quiz was not that hard because there was always a clue where they could get the right answer.

I intentionally created a "friendly" quiz in the IMI. I could have made it harder by giving points for every correct answer and reducing points for incorrect answer. When the user saw his/her final score, it would be clearer to him/her how much he/she knew. I could also design it like a real quiz an actual class where the students could not change their answers after they had turned in the quiz. I might apply these techniques for an advanced quiz
whenever I have a chance to upgrade the IMI in the future. In addition to the interview, I asked them to fill out questionnaires regarding their experiences using the navigation buttons and the quiz at the IMI.
Figure 5.5: questionnaire results of the navigation and quiz presentation
Question A: The program presents a clear navigation system.
Question B: The navigation system gives easy access to all area in IMI.
Question C: The level of difficulty in the quizzes is reasonable.
Question D: Multiple choice quizzes encourage me to read reading material more thoroughly.
Question E: Matching quizzes encourage me to read the reading material more thoroughly.
Question F: Information of each question in the quizzes is helpful to find further material explanation.
Figure 5.6: questionnaire results of the navigation system presentation
Figure 5.7: questionnaire results of the quiz presentation
Interactivity

In this section, I evaluated whether the students were able to use the IMI CD-ROM independently, or if they needed the assistance of the instructor. I developed the teaching concept in the IMI to enable students to learn by themselves. The idea was to allow students more choices in learning about animation. They could choose when and where they would use it and have a choice of the teaching material presented. For this reason I let all participants keep the CD for a couple of weeks to examine it freely.

Jack Gordon

When I asked Jack Gordon whether he wished to have an instructor help him when using the CD, he said no because he was a computer-literate person. He said that he was more concerned with the noncomputer users because they might have a hard time understanding the "Main Map," "Pop-Up Map," "Index," and "References" buttons. He told me that it might be easier for them if I could explain the function of these navigation buttons on a page. In general, Gordon thought that a self-study method might be appropriate for the CD. He said, "... it will not be too hard to use this CD-ROM without an instructor, because the buttons are there and the users can try using them and moving around a little bit and then these buttons can be self-explanatory."

Jack Miller

Jack Miller thought that the CD could be used for either an animation class or for learning by oneself. He explained that the user could
easily find the right answers in the quiz by using the "Information" button. Because of this, no instructor was necessary to use the CD.

**Arnold Peterson**

Arnold believed that the freedom in using the CD was very useful for him. He said that he could take the CD to his apartment and use it as long as he wanted. He could also take it to the computer lab where he worked and used it whenever he had free time. He said, "I really don't want an instructor hanging around my shoulder to show me how to use this."

**Bruce Reinhardt**

As Arnold Peterson, Bruce Reinhardt also thought that it was possible to use the CD without an instructor. This was because all of the controls were very straightforward and easy to use. He added that an instructor might be needed to help find other animation information outside of the IMI CD-ROM.

**Denise Liu**

My next participant, Denise Liu, believed that she did not need an instructor and said, "I don't need anybody to tell me how to use this CD-ROM." She thought that it does not take a computer-literate person to be able to use the IMI.
Timothy Jackson

When I asked Timothy Jackson about the self-study method for the using the IMI, he explained to me his experience in working with a similar project for Apple computers. He said that he and his colleagues created a self-learning workstation for elementary school students. During the tryout, the students tended to like to sit and explore the program by themselves rather than having an instructor dictate the information. He felt the same way about using the CD because it was easy enough to use and learn by himself.

Ching Shia

Ching Shia strongly believed that the CD was more appropriate for self-study. She said, "There is no way you can use it in the classroom because then the students want to click to all of these buttons." I was not sure about this, because I had not tried it in the classroom. I felt the CD could be useful for class activity depending on how the instructor organized the class activity. One instructor in the Art Education Department suggested that the instructor could give a reading assignment from the CD and discuss it later in the classroom. Possibly in computer classes students might be more interested in things other than the class materials being presented. Especially when the computer had a World Wide Web access.

Mark Jones

Mark Jones thought that it was better for him to be able to explore the CD on his own. He enjoyed exploring it at his own pace. This was because he
liked to jump from one section to the other. If something interested him, he would then start to examine it.

**Patrick Stevenson**

Like Mark, Patrick Stevenson would rather have no instructor while going through the content of the CD. This was because he believed that the best way to learn something was just to mess around with it. He said, "... I think to have an instructor with it you might kind of let the instructor do it instead of you doing it for yourself. So, it is better just to let people use the CD by themselves."

**Mark Simmons**

As other participants, Mark Simmons also thought that self-study method was appropriate to use the IMI. He did not feel an instructor was needed to help him find things in the CD. He thought that it was easy to navigate and to access all teaching materials by himself.

Although all users felt that self-study method might be appropriate for using the IMI, not all of them voted the same way in the questionnaire (see Figure 4.8). Denise, for instance, voted "Strongly Agree" for the question "B": whether an instructor's assistance would be more helpful to learn with the IMI. And she once told me firmly that she did not need anybody to tell her how to use the CD. I assumed she might not read the question correctly or misunderstood something.

Based on the participants' opinions, I believed that it was possible to use the IMI without an instructor. However, I understood that it could not
replace the teacher's position completely in the classroom. The IMI cannot offer any human teaching activities such as evaluation of the user's animation assignment, discussion about animation improvement or exchange a point of view. More than this, the IMI could not offer encouragement or guidance the way actual art educators can.
Information:

■ = strongly agree  ■■ = agree  ■■■■ = strongly disagree

□ = uncertain  □□ = disagree

Figure 5.8: questionnaire results of the self-study method for the IMI
Question A: Self-study mode is an efficient learning method of using IMI.
Question B: An instructor's assistance would be more helpful to learn the material in IMI.
Question C: The IMI is very useful to teach appreciation of animation.
CHAPTER 6

CONCLUSION

After creating the IMI CD-ROM and arranging evaluations with my research participants, I realized that the CD will probably be easy to use for both computer novice users with no animation background and for advanced computer users with broad animation background. All my participants found new information concerning Western animation that they never knew before. This indicates that the IMI is suitable to introduce the users to new artistic experiences and values.

Because I designed the CD to be user-friendly, most students did not feel that they needed an instructor to help them to use the CD. All participants thought that the self-study method was sufficient for the CD. This gives the students freedom to use it at anytime for as long as it takes to learn from it.

For the field of Art Education, the IMI CD-ROM can be used as a new teaching and learning tool that cannot be found in the traditional teaching system in the classroom. For instance, as an art educator, I was able to program my teaching curriculum and organize the teaching information
specifically into the CD-ROM. I do not have to bring a VCR, tape recorder, or slide projector in the classroom to show examples of animated films. Moreover, I do not have to be in the classroom to teach the students about Western animation.

What the IMI CD-ROM offers for the field of Art Education is choices and opportunity to organize teaching and learning activities for both art instructors and students. I did not create the CD to replace the role of the art instructor in the classroom because, so far, no technology in the world could replace the capacities of human instructors. No machine could offer mutual feelings between instructors and students, or offer encouragement and support. As an art educator, I believe that these qualities are important to the education process. Although the IMI cannot produce such a human relationship, it can offer what a machine does the best: consistency, accuracy, instant accessibility, and vast amounts of information.

The Implications for the field of Art Education

I realized that there are many ways to teach art education courses. An art educator does not always need computer technology to teach in a classroom. Nevertheless, art educators would have more teaching and learning experiences and possibilities if they are computer literate. Computer technology offers immeasurable things to the field of Art Education. For instance, computer graphics software enables art instructors and students to create various type of visualization, animation-making processes, and artistic presentations. Art educators can also create interactive multimedia teaching curriculum. Through the Internet, computer technology provides easy access
to various art-related information; communication among art communities, art educators, and students.

In my opinion, learning should be fun. The idea of using computer technology to teach helps to make the learning process more interesting and appealing. Art educators must be able to understand computer software and hardware available in the market, what equipment is the most appropriate for creating the teaching design, how to put information in the computer, how much memory is needed to present certain amount of information, and how to present a clear and stimulating teaching and learning strategy to create an interactive multimedia teaching design. Additionally, art educators have to understand the concepts of graphics design and fine art. Having artistic skills and ability are important in order to create interesting layouts and entertaining learning environments.

The art educators should have some programming skills to organize the teaching presentation or navigation system in the teaching design. Limited programming skills might impede the instructor's ability to create accurate learning systems. Good computer scripting is essential for producing clear and understandable navigation systems. Accessibility to all sections in the teaching design is also crucial. The users should not be confused or get lost in accessing certain sections because this may discourage them from further learning. As in teaching in the classroom, the instructor should be able to motivate the students to learn. The educators have to put themselves in the users' position to understand what that needs to be created.

Because there are so many things an art educator has to know to create a proper interactive multimedia instruction, Art Education Departments should offer computer multimedia courses for art educators or students who
want to learn this process. I learned to create the IMI by myself and I understand how painful it can be to try to solve problems alone. Because I have no computer science background, I found that writing computer scripts in Lingo authoring language was the most difficult part in creating the IMI. For some art instructors, reading authoring manuals by themselves can be difficult and confusing. By taking multimedia courses, students do not have to deal with their problems alone because instructors can help them out. The instructors should know the best resources for using authoring softwares and the concept of creating interactive multimedia instruction designs.

It is always useful to examine other interactive multimedia instruction packages available on the market. By observing their designs and material presentation, I had better ideas to improve my IMI. I always found the negative and positive aspects of each design that were useful in analyzing my design. Nevertheless, I always tried to come out with my original layout design.

Future Plans for the IMI

I am planning to improve the IMI by adding more accurate data, revising the writing, and corrections to several scriptings. The sections that need to be broadened are the "Pioneers of Animation," "Experimental Animation," and "Quiz." The IMI does not inform users about pioneers other than Winsor McCay, James S. Blackton, John Bray, and Emile Cohl. There are many other significant pioneers that should be mentioned. The "Experimental Animation" does not include modern artists in the 1980s and 1990s. Because of the data storage problem, I had to limit the amount of
information to be presented in the IMI. But I can produce a second volume of
the IMI that provides more information.

With several volumes of IMI, I can divide the level of information
from elementary to advanced level. The IMI that I currently designed
presents broad and vast subject matters, but does not provide depth or details.
I only covered the surface of the theoretical and historical aspects of Western
animation. The IMI is not sufficient for providing comprehensive
explanations about the movements and developments of animation from the
eighteenth century to present day. The IMI does not reveal comprehensive
social aspects for all types of Western animation. It does not explain the
relation between society and each animation movement, the cultural
influences of every invention in animation techniques, nor the affects of
social interest into the progression of animation styles. Nevertheless, based
on my research data and trial with the participants, I believe that the IMI is
comprehensive enough to introduce the historical and theoretical aspects of
animation to undergraduate students who are interested in learning but have
no chance to take extensive animation courses.

I created the "Jigsaw Puzzle," "Matching Puzzle," or "Multiple Choice"
for the "History," "Pioneer," and "Techniques of Animation" major sections
in the IMI with quizzes that only provide global questions for each major
section. For instance, there is no special quiz about the "European
Experimental Animation" in the "History of Animation" section. I could
arrange more specific quizzes in a more advanced design of the IMI. With a
more definite quiz, the user can quickly test his/her knowledge and
understanding of important data in this section. I could also design a more
difficult type of quiz that would measure the users’ knowledge by counting

154
points for every correct answer and subtracting points for every wrong answer.

Although the IMI was especially designed for self-study teaching and learning, I believe that it could be useful for teaching in the classroom. The IMI could be used as a textbook, an encyclopedia, a quiz provider, and entertainment. As with textbooks, the instructor could give students' reading assignments from the IMI. The students could locate information in the CD that was mentioned in the classroom. Then the instructor could lead class discussions or critiques concerning certain animated films or artwork in the IMI.

To use the IMI in the classroom, the instructor has to provide enough CDs for all students. This is not a big problem because the cost of an empty CD is only $6 to $10. Because the facilities to duplicate CD-ROMs is available on campus at The Ohio State University, it would be easy for an instructor to provide a CD for each student.

The only serious problem is having to obtain permission to use the still images and film clips of the IMI from various commercial animation production companies such as Disney and Warner Brothers. Without their permission, it is not probable to use the CD in the classroom. Under fair-use doctrine, it is possible to use some information for education purposes. But every company has its own copyright policies. Some companies will demand some financial share even if the IMI CD-ROM was not produced for commercial purposes. The reason is because even an educational institution charges the students to attend classes. Because the school earns income from tuition fees, the commercial companies think that it is valid to have certain financial allowances.
BIBLIOGRAPHY


