TOWARD AN ADAPTED SYSTEMS DESIGN MODEL
FOR INSTRUCTIONAL DEVELOPMENT

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(ABSTRACT)

This study was conducted primarily to discern ways of adapting traditional instructional design models to better guide educators whose most typical design problem is one of "repurposing" commercially materials to meet already established instructional needs. The problem of using existing materials to satisfy already established goals and objectives is considered in this study to be a uniquely different situation than was envisioned in those cases where designers use systems approaches to develop complete instructional packages. Yet, many educators will find this ideal version of design work difficult to satisfy and rarely have the opportunity (with appropriate resources) to design instruction "according to the book". This research, therefore, was undertaken to provide a practical example of design work, utilizing an interactive video design problem.

The strategy adopted in this study consisted of the following: 1) The author produced an interactive video lesson which could exemplify the potential of repurposing and reveal the design problems encountered; 2) Each of the design "steps" or moves made by the author was preserved through an extensive set of designer notes as well as an
audiotaped record of designer and participant comments. In this study, the author’s think-aloud protocols were used as data along participant’s comments; 3) These process data, the design notes and the audiotaped records were subjected to qualitative analyses borrowed and adapted from standard ethnographic research procedures; 4) Subsequent considerations for repurposing were abstracted from the qualitative analyses and presented as practical guidelines for designers working in an interactive environment.

Of primary interest is the adapted systems design model developed for this study. This model illustrates five considerations for repurposing which deserve special attention: 1) repurposing actually beginning in the middle of the typical design sequence; 2) the matching process which exists between available materials and the existing goals and objectives which has to be satisfied; 3) the effective utilization of repurposed materials in instructional lessons; 4) the reconstruction of the repurposed materials into an acceptable instructional lesson; 5) the creation and incorporation of additional materials which are needed in the instructional unit. Visual illustrations showing the relationships between these considerations and the typical design scenario are presented in the study. The adapted model presented in this study provides for those instructional designers, who rarely have the time or expertise, a practical set of procedural considerations.
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CHAPTER 1

INTRODUCTION

The development of new technologies, such as interactive videodiscs, synthetic speech hardware or touch screen devices, are expanding considerably the instructional tools available to educators in a variety of educational settings. Almost taken for granted is the ability to adapt instruction based upon individual learner needs, the capability to present audio-visual experiences over which the learner has some control, and the ability to have a computer speak directly to learners. The instructional possibilities created through these new and emerging technologies may give renewed hope that answers to many of today's educational problems can be found. Kulik, Bangert, and Williams (1983), for example, found that learner achievement can be improved as much as 50% through computer assisted instruction (as compared to traditional instruction), and that the amount of time necessary to accomplish the same amount of learning was reduced. Such findings are not new, (see, for example, Skinner's (1987) reflections on instructional improvement) but for various reasons, promising innovations often do not translate into
effective practice.

One factor which could enhance the spread of new technology and improve instructional programming generally is the availability of high quality, commercially available instructional programs. Instructional videodiscs are one such example. Videodiscs are available today in a wide variety of curricular areas, and many are quite sophisticated in both content and presentation of material. (See Appendix A for a sample listing of videodiscs). Such videodiscs combine with other technologies, old and new, to provide an increased number of choices for developers of instructional programs. Designers still have the option of creating instructional programs from scratch, but in today's instructional material marketplace, that option may be a less and less desirable one in terms of both cost and quality.

In reality, instructional development in public school situations are dominated today by the use of off the shelf materials, such as texts, films, workbooks, and lab manuals. Those who design instructional programs (e.g., teachers, curriculum specialists, or even professional design experts) may apply their own modifications to existing materials, but rarely does one see, in these settings, instructional programs which have been designed from scratch using traditional instructional design
methods. Instructional development based on new technologies, such as interactive videodisc, will probably run the same course.

What are the actual design problems encountered when one attempts to produce instructional programs which draw heavily from existing materials and activities? This question is the focus of the present study. An example using the relatively new videodisc technology will serve to illustrate some of the dimensions of the problem. In science education, for example, it is now possible to find and purchase a fairly large number of commercially available videodiscs dealing with a variety of topics. NASA currently offers a series of such materials at a cost of approximately $300.00 per disc (development costs for such discs would run in the tens of thousands). This particular instructional series is designed for a relatively restricted audience, with a basic vocabulary aimed at about a ninth grade comprehension level. Yet, the videodiscs contain an enormous amount of visual material, potentially useful for a wide range of age groups and content interests. Two audio tracks are available as well, which can be used interchangeably to orient the material toward more or less advanced audiences.

The problem for the practical designer is how to make the best use of such materials -- materials which far
exceed in technical quality and extensiveness most products that could be developed by a single individual or small group operating within a limited budget. Should the materials be used as is? Probably not, given how unlikely it is that the material will fit exactly the designers objectives, audience and/or timeframes. The more likely scenario is that the local designer will have to make certain modifications or changes that essentially retrofit or "repurpose" the existing material to meet current instructional needs and conditions.

Repurposing available materials to meet changing instructional conditions is probably the most common kind of design work done in education. Books, films, videodiscs, and so forth are the mainstays of instructional programming, but rarely are they used exactly as intended by the original designer. What happens during the repurposing process? Little is currently known because this type of design work is done intuitively, without very much guidance from formal models. By contrast, designers who produce programs from scratch typically refer to elaborate design models, such as Landa's (1983) algoheuristic theory of instruction or Reigeluth and Stein's (1983) elaboration theory of instruction, which specify in great detail the steps required to create programs that are internally consistent and that work. Guidelines of this
sort would be highly desirable in the "repurposing" environment, but at this time do not exist. Nor do the existing "full scale" models provide the explicit help needed. The purpose of this study was, therefore, to examine explicitly the essential tasks involved in repurposing existing materials to meet new goals, audiences and contexts. This objective was accomplished though the following activities:

1. A detailed example of "repurposing" was created where the author essentially reconstructed material from an existing videodisc on photography to yield a new interactive video lesson to meet new objectives and audiences.

2. Subsequent detailed records of the repurposing process were created for qualitative analysis.

3. Guidelines were created from the qualitative analysis which illustrated in detail the design problems encountered and the solutions generated for the interactive videodisc example.

4. Finally, way of adapting traditional design models were proposed to yield frameworks for looking systematically at repurposing as a general design problem worth of solutions in its own right).

The remainder of this chapter examines current views of instructional design and discusses potential problems
which can arise from the utilization of traditional models in the repurposing environment described above.

CURRENT VIEWS OF INSTRUCTIONAL DESIGN

Many models of systematic instructional design exist, with some of the more prominent examples written by Dick & Carey, 1985; Gagné & Briggs, 1979; Reigeluth & Stein, 1983. Most of these models involve the designer in a variety of activities such as identifying instructional needs, conducting task analyses, creating objectives, designing materials and instructional strategies, as well as conducting various types of evaluations and revisions. For the purpose of this study, one model, Dick and Carey (1985), will be used as a standard example to represent the field as a whole. This model (see Figure 1) begins with the identification of instructional goals and development of objectives, and concludes with formative and summative evaluations. As Dick and Carey (1985) state, "instruction is a systematic process in which every component is crucial to successful learning" (p. 2). They describe their system as a series of interrelated parts, working together towards a defined goal. As is denoted in Figure 1, each component of the Dick and Carey model receives input from each preceding component and provide output for the proceeding component. For example, based upon the goals and objectives developed for an instructional lesson, specific
Figure 1
Dick and Carey Systems Approach Model
test items will be developed. Each of the components of the Dick and Carey systems design model (identifying an instructional goal, conducting an instructional analysis, identifying entry behaviors and characteristic, writing performance objectives, developing criterion-referenced test items, developing an instructional strategy, developing and selecting instruction, designing and conducting the formative evaluation, revising instruction, and conducting summative evaluation) depends upon feedback to determine if its desired goal has been met. If this goal has not been achieved, the system is modified until it has been reached. To this end, Dick and Carey repeatedly emphasize the important role of the interaction of each component in the systematic design of instruction.

If a designer has the time and resources available, the Dick and Carey systems design model provides an exceptionally strong basis for the development of instruction. Unfortunately, many practical design situations leave the designer with neither the time nor the resources to faithfully carry out the job as specified in these models. Moreover, to compound the constraints placed upon the instructional designer, special guidelines and objectives are often prescribed well before the design process can begin. One example comes from a study by Higgins and Reiser (1985) in which the designers were given
the task of developing instruction which would train bank managers utilizing role-playing techniques. The designers could only devise instruction in which the manager interacted with a "customer" in a one-on-one situation. In typical public school settings, typical design procedures are even further constrained when objectives/goals are state-mandated or when they come on specific terms from local school boards. The designer must then attempt to reconcile accepted design philosophy with a host of external mandates which can influence the entire process.

An additional constraint can enter into the design of instruction when the use of a specific technology is warranted. Many times, the designer may wish to use a technology which has been shown to have positive educational potential and is available, yet carries with it the factors of added expense and amount of time needed to produce materials from scratch. For example, interactive videodisc technology provides the capabilities to quickly access information which is available on the videodisc, a large information storage capacity, and the flexibility to adapt to varying student needs. However, the original creation and mastering of a videodisc can begin at $10,000 and proceed upwards. Authors who write about these new technologies are clearly aware of the constraints involving time, money, lack of design expertise
and a host of other contextual factors, but frequently ignore them, as did Harmon (1982), by stating that "these constraints will not be pursued in this article" (p. 15).

One possible solution to this problem -- the difficulty of infusing new, expensive and labor intensive technology into today's classrooms - would be the systematic use of materials professional prepared and commercially available, but perhaps not exactly on target with required goals and objectives. This solution, however, is impeded by the lack of a design model which addresses the process of repurposing such materials to meet existing needs.

Dimensions of Professional Design Work

Many authors have written about the design of instruction as a professional science which essentially links theory with day to day practice. For a good overview of current design philosophy and practical advances over the past 20-30 years, see Reigeluth, 1983. According to Reigeluth, "The result of instructional design as a professional activity is an 'architect's blueprint' for what the instruction should be like. This 'blueprint' is a prescription as to what methods of instruction should be used when for that course content and those students" (p. 7).
Blueprints, however, come in a variety of forms and derive from different theoretical frameworks. Hannafin (1985) has proposed that "the conditions of learning" described by Gagné and Briggs (1979) represent a good model for the design of instruction. Instruction, ideally designed according to the Gagné and Briggs model should promote those conditions which stimulate executive control, facilitate the encoding of information into permanent memory, and which aid in subsequent recall. In working with these concepts, however, the designer of any particular instructional system must discover the methods which work best for the material being presented. Reiser and Gagné (1983) have created a model which utilizes a flow-chart technique for the selection of appropriate media. Media selected according to this model are then evaluated on the basis of practicality and allow for special conditions, such as modality of presentation and type of information which is to be presented, which have been shown to improve various types of learning. The designer should be aware of these multiple design considerations, realizing that instructional design as a professional activity offers many possible ways to organize information.

B. F. Skinner (1987) is currently repeating his recommendations for individually programmed instruction
presented and managed by teaching machines. Skinner's argument and lifetime of original research yield another source of conceptual guidance for the design of instruction. Skinner still maintains that programmed instruction can often produce learning in half the time with half the effort as typical classroom instruction. Depending on the theoretical basis chosen by the designer, special attention must be paid to certain behavioral and/or cognitive issues. From a behavioral perspective, the concepts of how information is presented, pacing of individual students, and feedback/reinforcement should all be dealt with in a consistent manner during the design of instruction.

From a cognitive perspective, prior knowledge, the context in which material is presented, and the stimulation of appropriate information processing strategies (Shuell, 1986) are all high priority considerations. Deshler and Gay (1986) have described how the use of visual images can be used in expository learning, where illustrations, diagrams and maps provide examples of facts, concepts, or principles. These are, again, factors which must be evaluated when creating instruction.

Whatever the theoretical perspective followed, most design models have one thing in common -- particularly those referred to as "systems" models. This common
characteristic is the complete, integrated character of the design process. All components of the design model (e.g., objectives, materials, strategies, tests, etc.) must fit together in a way that makes the instructional program internally consistent and effective in terms of solving the instructional need. As Reigeluth, Gagné and Briggs, Dick and Carey, and Merrill point out, there is good reason for this insistence on model integrity: it is simply one of the best ways known to ensure that the "design" will deliver what is intended.

The problem confronted in this study, however, is the difficulty one faces when operating outside of the typical design framework. Such cases have already been described earlier in this chapter -- cases where designers must "piece together" a complete instructional system from already developed materials (to save time and expense) and already mandated goals, objectives and strategies. In these cases, there is clearly a need to rethink how to proceed given the rather structured character of these models.

NEED FOR NEW DESIGN SOLUTIONS

In a typical instructional situation, an instructor must present a concept or idea that is part of some standard curriculum. Instructional goals and objectives have been defined, and the instructor must attempt to find
or develop materials which meets these goals and objectives. The instructor usually does not have the time, resources, and perhaps skill needed to develop original instructional material which is directed specifically towards the goals or objectives of that instructional unit. The instructor, therefore, attempts to find existing materials which address the goals/objectives of the unit. The goals and objectives for which these materials were originally developed may not necessarily match exactly the desired goals and objectives of the instructional unit. Gagné and Briggs (1979) acknowledge this situation and note the compromise often made between developing new material and finding existing materials for use in an instructional lesson. The instructor will often find in existing materials enough pertinent information to warrant adapting these materials to the task at hand. It is with this available material, existing goals and objectives that the instructor enters into the instructional design process.

In order to utilize these materials, the instructor will usually need to adapt them to meet the needs and objectives of the instructional unit being developed. This adaptation requires an in depth awareness of the information which exists in the materials as well as a complete understanding of the desired goals and objectives for the lesson being developed. Existing design models do
not address clearly this concept of using existing materials for goals and objectives other than the ones for which the materials were originally intended. One solution to this design problem would be the creation of an adapted design model which treats explicitly the problems encountered and steps needed in repurposing existing materials for new use. This adapted model should reflect a resolution to the conflict which the use of existing materials, goals, and objectives brings into the standard design model. This study, therefore, was designed to produce an adapted model of instructional design, based upon the premise that in many design situations, the constraints (noted above) on the instructional designer do not allow for the full implementation of a standard design model. The adapted design model created in this study incorporates possible solutions to the design constraints noted, and provides the designer with a more secure basis for design work under the conditions noted.

In order to create a practical data base for the development of this adapted model of instructional design, an interactive video lesson was created allowing the would allow the researcher to determine the design decisions utilized in the creation of that lesson. These decisions, in turn, were used to allow the researcher to develop the guidelines needed for the development of a lesson which
required the use of modified materials. The adapted design model presented in Chapter 4 was then derived from these design decisions and guidelines. A similar approach to the application of existing design models was utilized by Harmon (1982) in an attempt to develop a model for the analysis and development of instructional materials. In his study, a behavioral approach and a cognitive approach were combined in order to create a single, systematic approach.

THE USE OF VIDEODISC IN THIS STUDY

In the present study, a decision was made to utilize interactive videodisc technology for the instructional lesson process, as videodiscs provide an ideal context for adaptive design. The use of videodisc technology in educational settings has only recently been studied (see Dassance, 1986; Hannafin & Colamaio, 1986; Rhodes, 1985) and found to be a valid method of presenting information. Instructional videodiscs for math, science, art, and music, as well as other curricula, are now being offered to educators. Videodiscs contain both visual information (still frame and motion sequences) and audio information (usually two tracks) which has been arranged and developed by the original designer for a specific instructional purpose or goal. If, however, that same designer must meet a set of state requirements in science, and the videodiscs do not inherently meet those requirements, the videodiscs
must be adapted in order to meet those requirements. Once again, the constraints of meeting existing goals/objectives in conjunction with the utilization of existing materials are not addressed in the Dick and Carey design model. The adapted design model developed for this study begins a process which will eventually reduce those constraints and allow fully adaptive use of existing materials.

For this study, a videodisc entitled "Creative Photography: A Video Primer of SLR Photography" was used in the creation of the interactive lesson. This videodisc is representative of commercially available videodiscs: it contains both visual and audio information, divided into units, which present various concepts about photography, cameras, light, and photographic equipment. The material on the videodisc is presented in a linear format much like that of a television program, and the two audio tracks available on the videodisc have been developed for two different audiences (track one is intended for the novice photographer; track two is intended for the more advanced photographer). This videodisc was utilized for the development of an instructional unit much like one which would be developed by an instructor in a public school or college who needed to present information about photography. This was the primary criterion for the selection of this videodisc. There are, however, generic
videodiscs, which contain sections of material which are unrelated to each other. For example, a generic videodisc may consist primarily of unrelated still frames or information (such as an encyclopedic database videodisc which contains information about a great many subjects). This study, however, concentrated on the development of an adapted design model utilizing a videodisc sequence which was intended as a complete instructional episode.

**SUMMARY AND CONCLUSIONS**

In the review of the literature for this study, a need has been shown for research which examines the use of existing materials to meet objectives other than the ones for which they were originally produced. In addition, research is needed which provides the instructional design steps needed to produce instruction which utilizes these existing materials. Many authors have written concerning the creation and development of a systematic design of instruction, yet most have assumed that the instructional designer begins with a blank slate. An instructional design system which directs the user through the steps needed in order to best utilize existing materials must be developed.

As described, the adapted design model developed for this study will give much greater flexibility and power to the designer of instructional materials. The present study
consisted of the design, development, and evaluation of an interactive system which provided the basis for the creation of an adapted design model. Of primary concern was the development of appropriate instructional design guidelines which led to the creation of the adapted design model. It is clear that this model will allow for the utilization of existing materials in new design settings, and thereby provide an important source of high quality, flexible instructional materials for use in a variety of settings. The objective of this study was to produce this set of guidelines which allowed the researcher to develop the adapted design model presented in Chapter 4.
CHAPTER 2

METHODOLOGY

INTRODUCTION

The purpose of this study was to 1) produce inductively a set of guidelines illustrating the design decisions and strategies to be used in repurposing instructional material, and 2) propose an adapted systems design model for instructional development in the "repurposing" environment (discussed in Chapters 3 and 4 respectively). These guidelines and design principles were derived from design considerations utilized in the development of an interactive videodisc unit on photography. The instructional unit produced for this study yields approximately 35 minutes of interactive video instruction adapted from a commercially available videodisc on photography. The target videodisc was professionally produced and designed and provides the user with a linear unit of instruction consisting primarily of motion sequences and two narrative soundtracks.

Prior to this study, the author could find no design precedents for the repurposing of videodiscs to meet alternative objectives, audiences, or instructional time
requirements. While some work has been done on the general design and development of interactive videodiscs and videodisc materials (see, for example, Cohen, 1984; Hofmeister, Engelmann, Carnine, 1985; Jonassen, 1985), no attention has been given to the design problems associated with using existing videodiscs for purposes not originally intended. It is recognized also that many general design models are currently available to guide instructional development (e.g., Dick & Carey, 1985; Gagne and Briggs, 1979; Keller, 1983; Reigeluth & Stein, 1983), but the repurposing of commercially available videodiscs is a relatively new opportunity which has not been addressed in the design literature. This study addresses this potential through the development of an adapted design model and guidelines for the repurposing of interactive videodisc materials. Guidelines developed through the present study should add to the design literature as well as provide a practical source of information for educators and instructional designers who desire to utilize interactive videodisc technology without going to the considerable expense of creating original material.

DESIGN CONSIDERATIONS

This study was designed with two goals in mind. The first was to design/produce a unit of instruction which could serve as an example of how it is possible to utilize
commercially available videodiscs for purposes, audiences, objectives, and in formats not originally intended. This business of designing new interactive video instruction around already existing available videodiscs has been referred to in Chapter 1 as "repurposing". The argument was made that the design procedures underlying repurposing are substantially different from typical procedures found in well known instructional design models such as those cited above. Consequently, a second goal of this study was to create inductively a set of guidelines suitable for practitioners and researchers who wish to pursue further this concept of repurposing. Through these guidelines, an adapted design model was developed. Methodologically, the strategy adopted to meet these two goals was as follows:

1. First, the author produced an interactive video lesson which would exemplify both the potential of repurposing and the design problems encountered.

2. Each of the design steps or "moves" made by the author was preserved through an extensive set of design notes as well as an audiotaped record of designer and student "participant" comments.

3. All process data, the design notes, and the audiotaped records were subjected to qualitative analyses borrowed and adapted from standard ethnographic research procedures.
4. Design considerations for repurposing were abstracted from the qualitative analyses and subsequently presented as shown in Chapter 3. An adapted design model, which is based upon guidelines derived from these design considerations, is shown in Chapter 4.

Theoretically, the procedures followed here for discerning important design considerations in repurposing are somewhat similar to the "think-aloud" techniques used by researchers to identify critical aspects of experts' composing processes in writing (Hayes & Flower, 1980) and the decision making activities of expert teachers during teaching (see Peterson & Clark, 1978). In this study, the author's think-aloud protocols (see Appendix B) are used as data along with comments from participants who worked with the author testing and modifying various elements of the interactive lesson. Data from these two sources were combined with procedures found in extant design models to produce the guidelines detailed in Chapter 3.

Participants

Approximately forty undergraduate students from two educational psychology classes served as participants in this project. The participants were involved in testing various aspects of the interactive video unit during the formative stage of design, as well as testing the unit in a
summative fashion once the design procedures had been completed. Participants were equally divided between the formative and summative evaluation stages, and all were seen individually by the investigator.

**Equipment**

The equipment used in this study consisted of the following:

- IBM Personal Computer with 320k of memory
- 2 disk drives
- Pioneer LD-V4000 LaserDisc Player
- Amdek Color I video monitor
- BCD computer/ videodisc player interface
- IBM Voice Communications Adapter
- Pioneer LaserDisc "THE CREATIVE CAMERA: A VIDEO PRIMER OF SLR PHOTOGRAPHY"

Figure 2 shows the placement and set-up of the equipment used in this study.

**PROCEDURES**

This section describes the procedures followed during the development of the interactive lesson. Keep in mind that it was necessary to carefully document each step leading to completion of the lesson, as these data provide the basis for the development of repurposing guidelines. In the section which follows, an overview of the final
Figure 2
Set-up of interactive video equipment

A. Mini-Speaker    B. IBM Microcomputer    C. Amdex Monitor    D. LD-Y4000 LaserDisc Player
lesson will be given, followed by a discussion of preliminary activities and considerations, the evolution of the instructional unit, and final testing.

**Lesson Overview.** A student enters the computer lab, and following written instructions, inserts the appropriate disks into the appropriate equipment, and turns on the equipment. As the lesson begins, the participant must decide either to receive or not receive available synthesized speech information. After this choice is made, the system is initialized and the participant watches a video introduction which provides information about an upcoming photography lesson. At the end of the video introduction, the user enters his/her name, and receives textual information which tells the user

a) to take the pre-test (if this is their first time using the interactive photography lesson) and

b) that some of the information will be provided on a printout. The user is reminded to make sure that the printer is turned on.

The main menu appears, and the user selects the pre-test option. After answering twenty questions which comprise the pre-test (questions which cover photography terms, definitions, and use of equipment), the user receives a printout of a recommended viewing list based upon his/her responses to the pre-test questions. The user then has the option to view any or all of three units
consisting of information from the videodisc, or to select and view specific concepts from each of the units. Separate choices also allow the user:

a) to receive textual, video, or synthesized speech definitions about the photographic terms used in the unit,

b) to receive information about each of the choices which appear in the menu,

c) to take the post-test.

d) to quit.

At the conclusion of each of the video segments of instruction, the program returns to the main menu. Most participants view either the three complete units, or view selected video segments from those units. After the participant has completed the recommended viewings, several definitions are usually requested (by the participant) and this information is presented. After the user has viewed the information which was recommended and received and definitions which were requested, he/she takes the post-test. The post-test consists of twenty questions, with video remediation if a question is missed. If a question is missed, the user receives a second question based upon the same material. If this question is missed, the correct answer is given, and the post-test proceeds. At the conclusion of the post-test, the user is once again given recommended viewings based upon questions missed during the post-test. The program then returns to the main menu,
where the user can choose to review the recommended material or to quit.

**Preliminary Activities/Considerations.** One of the first activities in the design of the interactive lesson was the selection of the videodisc. "The Creative Camera" (Pioneer Video, Inc., 1981) was chosen because of the non-specialized nature of the content. Once the videodisc was selected, the videodisc was viewed several times. These viewings allowed the investigator to become familiar with the information and material on the videodisc. In this study, the development of goals for the instructional unit was influenced by the choice of videodisc and by the advice of a professional photographer who also viewed the videodisc. Introductory books on photography were also utilized in the development of the instructional goals which would relate to a beginning photographer.

As goals were developed, the appropriate material from the videodisc was cataloged and the frame numbers noted. As the material from the videodisc was being cataloged, it became clear that an overall map of the information on the videodisc would be of great value, if not a necessity. While watching the videodisc and through the use of a remote control unit which allowed for pausing, videodisc search and display of frame number, the author noted beginning and ending frames for the photographic
concepts presented on the videodisc, and a map was created. This map provided a listing of the frame numbers and concepts available on the videodisc and served as a reference point when specific material on the videodisc needed to be found.

The choice of a programming language to create the interactive program was included in the preliminary activities. Because of the author's previous experience, the PILOT language was chosen for this study. As noted in Chapter 3, this choice produced some interface problems with the Voice Communications Adapter which produced the synthesized speech. Utilization of a short, author created program allowed the video information to be displayed and the beginning and ending of each video section checked. This proved to be very important as often the audio and video sections for a specific concept on the videodisc did not coincide exactly. An initial program which presented the desired videodisc information was then created.

Included in the preliminary activities were several practical design considerations which affected how some information was presented. Initial plans included presenting textual information using a variety of text colors and background colors (several are available on the IBM computer). Several hours were spent by the author attempting to find appropriate text and background colors.
Many combinations of text and background colors were tried, and after testing white text on a black background was chosen for its legibility.

Types and amount of questioning to include in the pre-test and post-test were also evaluated. Merrill's (1983) recommendations for question presentation were used finally as guidelines for the creation of both the pre-test and post-test items.

**Evolution of the unit.** During formative evaluation, as each section of the interactive unit was being developed, student participants would watch and interact with the lesson. During the process, the students had access to a 35mm SLR camera which could be examined and manipulated if desired during the interactive lesson. As each participant was interacting with the lesson (making selections, viewing information, answering test questions, making decisions about what to do), the investigator would question the participants for reactions, and for feedback during problems and misunderstandings. As the lesson developed, participants' interaction with the lesson became more involved (more choices, more decisions to make) and the amount of information provided to the researcher increased rapidly. Participants were constantly questioned as why they made a certain decision or choice. Participants would make comments about the method in which
information was presented or misunderstandings which occurred. Participants were reminded to talk about anything which came to mind. In addition, the investigator would note any problem which occurred during the lesson. For example, several of the participants did not know the location of the return key on the computer and asked where it was located. This lack of knowledge led to the inclusion of this information in an instruction sheet for the participant. In another example, several of the participants asked which information they should view. This led to the development of "recommended viewings" for the participant which were then printed and given to the participant. The needs of the participant, improvements to the interactive lesson, and recommendations from the participant were noted as a result of this investigator/participant interaction. As each section of the interactive unit was developed, information which needed remediation or information which was not available on the videodisc was designed, tested, and developed. For example, participants stated that some of the information on the videodisc was presented too quickly. This led to the development of textual definitions. Definitions could then be offered as an option to the participants. This option allowed the participant the opportunity to write down the definition or to clarify a definition which had
been presented through a video segment.

The use of synthesized speech to present information was also tested. It was discovered that, due to the nature of the computer program, the synthesized speech could not read information which appeared on the computer screen. This eliminated one possible use of the synthesized speech. Synthesized speech was also tested to provide positive feedback to the participants. This use was eliminated due to the large amount of disk space needed for each synthesized speech passage (approximate 12k to 15k for each synthesized speech use) and the small amount of disk space available for this purpose. It was decided to utilize the synthesized speech to provide clarification of information on the videodisc and to provide information which told of the differences between the camera which was shown in the videodisc information (a $600 Nikon) and the camera which was available for the participant to manipulate (a $250 Pentax). This seemed the best use of synthesized for the amount of disk space available.

As each section of the interactive lesson was created, testing occurred. A typical development session consisted of the creation of two to three different methods of presenting a concept. Each of these concepts were then tested utilizing the participants for feedback. As each participant interacted with the instruction, any problems
with the various methods of presentation were noted and solutions incorporated into the next program design. Benefits of the various methods of presentation were also noted and included in subsequent program changes. The formative evaluation and design procedure proved to be a circular one: procedures were created, implemented, tested, recreated, etc. Testing results were constantly incorporated into program changes, and those changes were then also implemented and tested.

One design feature which was incorporated into the interactive lesson was the use a disk file (a dribble file) to keep track of the participant's responses. During formative evaluation, the disk file which kept track of the responses made by the participants was analyzed to discover information which was being misunderstood and questions which were being missed by the participants. This analysis led to several program changes. For example, the dribble file showed that students were pressing T or F when required to answer True/False questions. The correct response, according to the program at that time, would have been either an A for True or an B for False. After analysis of the dribble file, the change to T/F was incorporated into the interactive lesson. As a result of this extensive formative evaluation and the on-going analyses of both the written and oral materials which were
created as a result of this evaluation, an effective unit of interactive videodisc instruction was created.

**Final Testing.** Twenty-four students participated in the summative evaluation of the lesson. During final testing, the interaction between the participant and the photography lesson was the same as noted in the lesson overview. When each participant finished the lesson, he/she was interviewed by the researcher for reactions, attitudes, and possible uses for an interactive system in their curricular area. An analysis of the file which kept track of the participants' responses provided pre-test, post-test, and choice information.

The pre-test scores of the participants showed a mean of approximately 45% (low score of 30%; high of 90%). Participants' post-test scores were approximately 86% (low score of 65%; high of 100%). No single question in the post-test was missed consistently by the participants. The average number of choices made by a participant was 64. This includes a minimum of 40 choices needed to answer the pre-test and post-test questions.

**DATA SOURCES AND ANALYSIS**

This study began with the problem of developing an potential guidelines and an adapted instructional design model to address the problems which educators face in
attempting to repurpose existing instructional materials for new situations. The solution to the problem, in the case above, involved retrofitting the photography videodisc to meet the requirements of a new set of instructional conditions. In order to describe the procedures utilized in reaching a desired solution, the researcher maintained a record of written and taped interactions with participants during the formative evaluation process. A similar record was made containing the author’s own comments, thoughts, and adjustments during the lesson development. A taxonomic analysis, based on Spradley’s (1979) description of ethnographic research, was then used with the available data set.

**Ethnographic record.** In conducting this study, a think-aloud strategy was utilized throughout the design process to trace the decision making steps involved in creating the repurposed instructional unit. This think-aloud strategy involved both the investigator (as the instruction was being designed) and the participants (as they interacted with the instructional lesson). As each participant interacted with the instructional lesson, he or she was interviewed and questioned as noted above. One form of the think-aloud strategy, as described by Ericsson and Simon (1984), involves examining verbalizations depicting the participants’ thought processes. The
analysis of these verbalizations was important to the final development of the repurposing guidelines.

Good examples of think-aloud techniques are found in certain ethnographic research projects, such as Spradley's (1979) research which examines the hierarchy of people involved with a city jail, where the researcher is attempting to develop a deeper understanding of a subject's culture. Upon completion of the researcher-subject interaction, a taxonomic analysis is typically applied in order to analyze the information presented in the think-aloud sessions. Spradley recommends utilization of the taxonomical procedure to create an in-depth analysis of the information resulting from the think-aloud sessions. In Spradley's taxonomic analysis, there are three key steps, as follows:

1. **Select a domain (a unit of knowledge) for taxonomic analysis.** Spradley recommends that this domain be the domain for which you have the most information. This domain will be further categorized in order to clarify the information which is present. For example, the category of "content considerations" was selected as one domain in the repurposing of videodiscs which is to be analyzed.

2. **Search for possible subsets among the terms included in the categories.** These subsets serve to further
organize the information which is contained in the proposed domain. For example, use of existing audio/video and presentation of information are subsets which serve to further define the category of content considerations.

3. **Construct the taxonomy.** Spradley recommends construction of both a tentative taxonomy and, after evaluation, construction of a final taxonomy. This taxonomy can then serve as an approximate representation of the ways in which the material has been presented. In this study, these procedures were followed for each aspect of the design processes involved in creating the interactive unit.

Each subsection of the proposed instructional unit (e.g., testing, presentation of information) consisted of a developed taxonomy, which, in effect, revealed the steps followed to reach the decisions for that unit subsection. A representative analysis for one section of the interactive unit follows:

**Goal:** Find videodisc information which should be included in an introductory interactive lesson on photography.

**Design Consideration:** The researcher will review the audio tracks on videodisc for material which discusses and best explains the concepts and information needed by a beginning photographer.
A think-aloud strategy was conducted in which the researcher verbalized his thoughts about the information which was being examined. This particular think-aloud session utilized the script which contains the audio information present on audio tracks one and two of the videodisc. The comments made by the researcher dealt with subject matter, method of presentation, possible ways to utilize information in an interactive lesson, and general comments about the material. Appendix B contains a sample transcript. At the conclusion of the think-aloud strategy, each statement made by the researcher was reviewed and the topics underlying these statements were extracted and developed into a taxonomy. The statements fell into several general categories: keywords, level of audience, planning/organization, explanations, or non-essential information. A superordinate category, design considerations, was selected as the primary domain for taxonomic analysis. Figure 3 shows this partial taxonomy. The development of this taxonomy meets the requirements of step 1 of Spradley's taxonomic analysis.

Analysis Procedures. After each of the general categories was determined, a further evaluation was undertaken to determine if subcategories were needed for the general categories. For example, under "level of audience", the subcategories of "expert/novice" and "one
Figure 3
Partial taxonomy for the category of design considerations
audience versus "multiple audiences" were identified. Upon determination of the subcategories, each utterance was evaluated and assigned to one of the subcategories or to the general categories, as required in Step 2 of the taxonomic analysis.

Several of the statements made about the audio track were applicable across categories. The markings on the transcript in Appendix B indicate taxonomic category. Of interest are the dual statements, that is, statements which discuss one or more areas of the taxonomy. For example, the following statement discusses the decision to use some words as keywords and also discusses how to best present these keywords:

OK. It seems like some of these words I'll need to emphasize as keywords (KEYWORD CATEGORY), like lens barrel. It will probably be a still frame or a audio track (PLANNING/ORGANIZATION CATEGORY, SUBCATEGORY B: PRESENTATION OF INFORMATION).

As this taxonomy was developed for each subsection of the unit, the essential nature of formative evaluation becomes obvious. The development of an instructional unit which made effective use of interactive technology required extensive formative evaluation to determine the best way to
present the information. For example, one section of the interactive unit was developed which presented photographic terms as definitions, displaying the terms as textual or visual information. This section was then tested and evaluated for the method which best presented the information. As each section was being developed, appropriate modifications which resulted from the testing were incorporated into the section and a taxonomic analysis was completed for the information presented. These analyses were then utilized during the development of appropriate guidelines for the repurposing of interactive videotrails.

**SUMMARY**

This study was an investigation of the design aspects involved in repurposing an interactive videotrail through the development of an adapted design model. The processes which led to particular design decisions were documented and subjected to the analysis procedures described above. Based on these analyses, design considerations and guidelines were developed and are presented in the next chapter.
INTRODUCTION

One major purpose of this study was to develop guidelines which will be useful to designers entering a fundamentally new and different arena of the design world; that is, the repurposing of commercially available videodiscs to meet a variety of needs different from the original purposes of the videodiscs. The purpose of this chapter is to describe the practical design considerations which resulted from the analysis procedures discussed in the previous chapter.

In general, videodiscs contain a variety of both visual (including motion and still-frame sequences) and audio information. Much like a television program, this information is designed and placed on the videodisc in a linear fashion, making changes in presentation order impractical. This type of linear format videodisc is becoming more widely available in a variety of subject areas. The videodisc used in this study is typical
of many videodiscs on the market today (see Appendix A). The designer of an interactive system, however, may find other types of videodiscs available. One type of videodisc, the generic disc, contains information (still frame and/or motion) which does not contain "units" of instruction. For example, the National Gallery of Art, for example, has produced a videodisc which contains still frames of many of the paintings in their holdings. Such a videodisc could be used to create an interactive lesson on art, artists, or various other subjects, such as history or social studies. The present study addresses the videodisc which has been designed and developed usually for one instructional purpose, rather than this type of "generic" videodisc.

Utilizing a videodisc which contained information about cameras and photography, an interactive lesson approximately 35 minutes long was created. The lesson was designed to demonstrate how material on the original videodisc could be modified and essentially placed within a new design framework. As this new interactive video lesson on photography was being developed, a major purpose of this study was to capture those "moves" which the designer made to accomplish the repurposing task. The remainder of this chapter will reveal those moves in the form of explicit
design considerations for use by designers and researchers who wish to pursue repurposing of interactive videodiscs. These design considerations will be discussed more generally in Chapter 4, where the goal is to propose needed variations or adaptations to existing instructional design theory.

Previous design models, such as that of Dick and Carey (1985), do not address repurposing. The designers and producers of most videodiscs have developed a completely integrated product. Specific goals have been identified, objectives have been defined, and numerous design considerations, such as development of instructional strategies and materials, have been planned, developed and incorporated into the final videodisc. The videodisc is then marketed, often directed at one audience for one purpose. The designer who wishes to repurpose this videodisc may encounter a unique design problem: the adaptation of both the original design decisions and the information which is available on the videodisc as well as opportunities to allow for the inclusion of design decisions and information which were not a part of the original videodisc. Under the present concept of repurposing, a product or process is adapted to the user whose needs were not originally considered. The designer who utilizes interactive videodiscs must still make
standard design decisions such as identification of instructional goals and strategies, creation of performance objectives, and conducting both formative and summative evaluations. Yet the designer also has the benefits (and negative aspects) which can arise from utilization of a previously completed design process. Throughout the design process for this study, extensive use was made of student participants who agreed to try out various aspects of the lesson and provide feedback to the designer. Many of the design considerations discussed in this chapter were generated directly from comments and suggestions derived from this kind of formative evaluation. Many of the decisions made in this design process came from suggestions contained in the design literature, such as those recommended by Freeman & Wasserman (1983), Gagne & Briggs (1979), and Schneiderman (1987), and were incorporated into the development of this interactive lesson.

Each design consideration listed below evolved from the attempt to solve problems which occurred during the development of the interactive lesson. The design considerations are organized, therefore, in terms of the the problem which existed, and the advantages of using the design consideration generated out of this investigation.
CONSIDERATIONS FOR USE OF VIDEODISC MATERIAL

In creating a lesson which uses interactive videodisc technology, there should exist a need which the videodisc can fill. Once a videodisc has been located which contains the necessary information, the development of an interactive lesson can begin. This lesson should provide a valid learning experience for the student and should be flexible enough to respond to a variety of users and user needs. Therefore, the designer of an interactive lesson must create a lesson which is both effective and flexible. The use of materials from the videodisc will greatly affect this lesson design.

- Have the goals of the instructional unit clearly in mind before you begin the design of that unit, and before you select your videodisc.

After I had purchased the videodisc on photography, I began the design of an interactive instructional unit by transcribing the audio tracks from the videodisc. I attempted to analyze and edit these transcripts with no clear plan or goals in mind. As I reached the conclusion of the transcript, I realized I had arbitrarily selected material to use or eliminate for the new lesson. Upon re-reading the edited material, I found that I had contradicted my choice of usable material in several
instances. For example, near the beginning of the transcript, I had eliminated information about aperture (because it was poorly defined in that section of the transcript). Near the conclusion of the transcript, however, I found a section which clearly explained aperture. At this location on the transcript, my process notes showed that I had indicated that aperture would be a good concept to be included in the interactive unit.

Development of goals at the very beginning will save time, help to clarify the designer’s intentions, and as I found, can reduce errors in judgment which could affect how the instruction is developed, presented, and evaluated.

- Go through the videodisc several times to find available video sections for possible use. Be aware of all information, both audio and video, which is available on the videodisc.

In trying to determine what information to use from the videodisc and also in selecting the both video and audio information which would work best for a unit on introductory photography, I found that I needed to be aware in detail of the information which existed on the videodisc. For this study, however, an improbable situation existed. I selected the videodisc before deciding upon the instructional use. A more realistic scenario would be a
teacher, who needs to teach fractions, looking for instructional materials. This teacher would find a videodisc and then develop an instructional unit from the materials on that videodisc. That teacher will need to be acutely aware of all the material, both audio and video, which exists on the videodisc.

Make sure that the videodisc is the medium you want to use; primarily, be certain that the videodisc contains the educational material that you need.

A videodisc described in a catalog, which may originally appear to be a panacea for your instructional problems, may not contain the information which you expected or need. For example, the photography videodisc utilized in this study does not contain sufficient information to allow for remediation if participants have difficulty with a concept. A concept on the videodisc will be presented once, in one manner, and then the videodisc proceeds to the next idea. Therefore, I, as the designer of the instruction, had to develop remedial material for these concepts. This material was developed and presented through synthesized speech and computer text screens.
MAPPING THE VIDEODISC

- Go through the videodisc and create a general map of the information which is present on the videodisc. (See Table 1). For example, FRAME 1 - 100 INTRODUCTION; FRAME 101 - 150 FILM TYPES. In addition, keep track of all chapter beginning and end frame numbers.

As a result of finding information on the videodisc which I wished to present, I began to look for information which would illustrate the goals I decided to implement. I spent many hours of trial and error, searching the videodisc in an attempt to find the video which best illustrated the point I needed to make.

By mapping the videodisc, much time can be saved in creating the interactive program, especially during the actual authoring of the lesson or unit. For example, after I created a general map of the videodisc, I knew that if I needed to present the information about the effect of film grain on the final image, I could go either to frame 26342 or frame 28212 and find that information.

This concept of effective mapping of the videodisc can be extended. While mapping the videodisc, I utilized a mapping system which allowed me to keep track of necessary information, as shown in Table 2.
Table 1

Map of beginning, still, and end frames from Chapters 2 and 3 from *The Creative Camera Videodisc*

<table>
<thead>
<tr>
<th>Concept</th>
<th>Beginning</th>
<th>Still</th>
<th>End</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chapter 2</strong></td>
<td>14850</td>
<td></td>
<td>19055</td>
</tr>
<tr>
<td>Introduction/</td>
<td>14850</td>
<td></td>
<td>15360</td>
</tr>
<tr>
<td>Focus &amp; Aperture</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>What lens is made of</strong></td>
<td>15370</td>
<td>15930</td>
<td>15930</td>
</tr>
<tr>
<td>Focus Indicator</td>
<td>15940</td>
<td>16400</td>
<td>16476</td>
</tr>
<tr>
<td>Plane of Critical Focus</td>
<td>16500</td>
<td>16520</td>
<td>16780</td>
</tr>
<tr>
<td>Aperture Control</td>
<td>16790</td>
<td>17150</td>
<td>17412</td>
</tr>
<tr>
<td>Aperture Size/Depth of Field</td>
<td>17750</td>
<td></td>
<td>19055</td>
</tr>
<tr>
<td><strong>-----</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Chapter 3</strong></td>
<td>22800</td>
<td></td>
<td>27730</td>
</tr>
<tr>
<td>Introduction</td>
<td>22800</td>
<td></td>
<td>24568</td>
</tr>
<tr>
<td>ASA/Film Speed</td>
<td>24650</td>
<td>25800</td>
<td>25820</td>
</tr>
<tr>
<td>Film Temp.</td>
<td>25825</td>
<td>26100</td>
<td>27000</td>
</tr>
<tr>
<td>Resolution</td>
<td>27000</td>
<td></td>
<td>27330</td>
</tr>
<tr>
<td>Grain</td>
<td>27330</td>
<td>27680</td>
<td>27730</td>
</tr>
</tbody>
</table>
Table 2

Frame Numbers and Concepts

<table>
<thead>
<tr>
<th>FRAME</th>
<th>CONCEPT</th>
</tr>
</thead>
<tbody>
<tr>
<td>14850</td>
<td>Beginning of Chapter 2</td>
</tr>
<tr>
<td>15000</td>
<td>Focus</td>
</tr>
<tr>
<td>15100</td>
<td>What lens is made of...</td>
</tr>
<tr>
<td>15900</td>
<td>Focus indicator</td>
</tr>
</tbody>
</table>
- When you have found video that you want to use, there are two steps which should be followed:

  a) Find the beginning and end frame numbers of each section which you want to use. Write down these numbers.

  b) Find the best still frames which show the concept which you are trying to illustrate.

Again, I found that the time spent looking for both the end of a video section and looking for a still-frame which best illustrated a concept was poorly utilized. I refined this system to include concept, beginning and ending frame number, and still frame number as in Table 3.

Still frame video can be used to emphasize an important concept which may otherwise be overlooked. In addition, still frame video with synthesized audio can alert the participant to important ideas or information. It should be recognized, however, that some concepts will not have an effective still frame of video on the videotrack.

**SELECTION OF INFORMATION FROM THE VIDEODISC**

- Choose only that information from the videotrack which best explains, represents, and helps the participant understand, the concepts and goals which you have selected for the instructional unit.
<table>
<thead>
<tr>
<th>Concept</th>
<th>Beginning</th>
<th>Still</th>
<th>End</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTRODUCTION</td>
<td>22800</td>
<td>+-</td>
<td>27730</td>
</tr>
<tr>
<td>ABOUT FILM</td>
<td>22731</td>
<td></td>
<td>24658</td>
</tr>
<tr>
<td>ASA - FILM SPEED</td>
<td>24650</td>
<td>25800</td>
<td>25830</td>
</tr>
<tr>
<td>TEMPERATURE</td>
<td>25825</td>
<td>26100</td>
<td>27000</td>
</tr>
</tbody>
</table>
Most videodiscs contain approximately one hour of audio-visual information. However, as I went through the videodisc with the lesson goals in mind, I found that much of the information which appeared on the videodisc was not needed for my instructional unit. If I utilized all of the information available on the videodisc, I would expand my unit to create several hours of instruction. Therefore, I decided to use only that information which I needed to effectively meet my goals.

This design consideration allowed me to concentrate on the best method of using the videodisc and presenting the information in my instructional unit. I then found the information which best covered the concepts I needed to present, as well as remedial material, and that was the information from the videodisc which I utilized in the lesson.

- Find video on the videodisc which best explains the concept and then try to find remedial video which presents the same concept in a different way.

While planning, I was looking for material which best presented a concept. I also tried to find material which could be used for remedial purposes (one of the benefits of an interactive system). During the formative stages of this project, I had participants compare videodisc material
versus textual material, and found that the visual tended to result in a higher degree of recall that did the textual. Students indicated that they felt they learned more from watching the video. One participant commented:

The pictures really helped you. If you wanted to see something, there it was.

One of the benefits of making the best use of the material on the videodisc is in that there will be less programming time required by the programmer. However, we should not use video from the videodisc simply to be using video. Remedial videodisc information, if available, can be useful in providing alternate learning experiences for the participant. If remedial information is not available, this information must be developed by the instructional designer.

- Check the location of the audio information on the videodisc when you are mapping for the visual information. It is better to have a bad video start (or ending), ie. have the video start (or end) with unrelated visual frames, than to have a poor audio beginning, which may cut off words or start in the middle of a sentence.

After mapping the videodisc, I created a program which would allow the user to view a segment of the videodisc. I
included, in this program, the correct beginning and ending frames for the video information. However, upon close inspection, I found that the beginning of the audio which explains a concept and the beginning of the video which shows that concept often did not coincide. During formative evaluation, I tried allowing the video to begin on the correct frame number, and received several complaints about the abrupt speech ending which accompanied the visual material. As a result of these complaints, the audio information from the videodisc was allowed to complete a sentence or phrase, which sometimes allowed unrelated visual information to be seen. This was accepted as a problem with the use of the videodisc.

- If more than one audio track is available, select the audio track from the videodisc which most closely applies to your audience.

Most videodiscs available have two audio tracks mastered along with the video information. The videodisc which I used contained two audio tracks: audio track 1 for the novice or beginning photographer, and audio track 2 for the more advanced photographer. As the instructional unit I designed was intended for use by beginning photographers, I utilized audio track 1.
- The audio track on the videodisc which is not the primary audio track of use for the presentation is a good source to find remedial information.

Utilizing the second audio track which was available on the photography videodisc enabled me to find additional information about photography and photographic terms. This information may be presented as definitions, may be presented as textual material, or may be presented through synthesized speech with a still-frame visual.

- Do not overlook the design decisions utilized by the original creators of the videodisc.

For example, when I attempted to find three to four definitions or explanations for the concept of resolution of a photographic image, I found that the definition from the original source of material is often the most helpful and proper one. In this example, I used the second audio track of the videodisc to find extra definitions.

Be cognizant, however, that the original design of a videodisc can and should be altered to address a given need. This adaptation, through the use of the computer, synthesized speech or other technology, can effectively change the perspective of the videodisc. By adapting the design of the videodisc to your needs, problems such as outdated or incorrect information, can be overcome.
- If possible, transcribe the audio track(s) from the videodisc. If this is not possible, transcribe the audio from the sections on the videodisc which you have decided to use.

When I first started watching the videodisc and as I was looking for information which I could use, I found that often I would need to write down the audio information which was being presented. I was fortunate in that I had the audio tracks for several units on the videodisc already transcribed for use. I found these transcriptions helpful in developing questions, definitions, and material to present through synthetic speech. Additionally, I found them to be beneficial as I was looking for specific concepts to match the goals I had planned to utilize.

The transcribing of the audio tracks on the videodisc, however helpful, does have a major drawback. Transcription takes a great deal of time. In this project, for the approximately fifteen minutes of audio track I did have to transcribe, I spent four to five hours producing a transcript.

- If possible, use video motion sequences from the videodisc for the lesson introduction, rather than still-frame or computer generated information.
In attempting to get participants interested in the photography unit, I created and tested several forms of presentation as follows:

a) presentation of audio and video motion sequence from the videodisc (the original introduction from the videodisc),
b) presentation of a computer generated graphic with text,
c) presentation of a computer generated graphic with some audio/visual material from the videodisc,
d) text only introduction,
e) no introduction.

Participants almost unanimously voted for the introduction which utilized audio and video motion sequences from the videodisc. Consistently, the participants commented positively on the use of the motion sequence at the beginning of the instructional unit, as well as throughout the unit. Comments of "I really liked it" and "I thought it was neat" were often used. However, one participant did mention that he was "shocked" to see so many pictures (the opening sequence from the videodisc is a collage of photographs which appear in rapid succession) coming at him all at once. The use of a motion sequence seemed to capture the participant's attention, and provided an advanced organizer on photography for the participant.
Additionally, the introduction allows the user to become used to the fact that the computer monitor is now acting more like a television than what is expected.

- Use the inherent motion abilities of the videodisc to show:

  a) parts that move

  b) conditions that change (light from indoor to outdoor, day to night)

  c) information (as in what happens to the film when the light enters the camera) which can not normally be seen.

If I needed to show what was happening on the inside of the camera, I could find the needed video. If I wanted to show what happens to a photograph when certain settings on the camera were changed, I had the necessary material. The use of the motion abilities of the videodisc allowed me to do things in an instructional unit which I would not have been able to accomplish due to cost, lack of time or equipment, or inaccessibility of materials. For example, the videodisc on photography allowed the participant to see what happens to the film when light enters the camera. This would be difficult to show in a regular class setting. Motion sequences available on the videodisc provided examples of conditions that change over time. The various aspects of natural lighting conditions (changing from day to night) were presented in an accelerated fashion through
use of a video motion sequence. These are instructional experiences which can be effectively and efficiently presented through the use of a videodisc.

USE OF SYNTHETIC SPEECH

As technology changes and improves, new considerations will be introduced into the interactive videodisc system environment. In this study, one such consideration was the use of synthetic speech technology to provide information which was not available on the videodisc. In order to determine how best to utilize synthesized speech, synthetic speech was included in the formative evaluation process. This testing provided possible uses for synthetic speech in the interactive video environment, as well as producing guidelines for its use.

- Offer definitions visually, textually, and if appropriate, through synthesized speech.

As the interactive unit was being developed, I found that there were certain photographic terms which needed to be defined. I developed versions of the interactive unit which presented the definitions three ways: through text only, utilizing the definition which was available on the videodisc; through the video material; and through the use of a still-frame audio (through synthesized speech) which provided an elaborated definition which was not available
on the videodisc. I found that generally, the participants requested all three of the forms of the definition.

Visually, the participants can see any action which is supposed to occur. Textually, they can read or write down any information which they need, and through synthetic speech, the designer can provide information which the videodisc omits or needs changing or elaboration. This provides a most varied and beneficial learning experience for the participants.

- Use synthesized speech information which elaborates upon information on the videodisc or which offers information (where needed) which is not on the videodisc.

One of the weaknesses of videodisc technology is the lack of audio in a still-frame environment. With the pre-mastering of an audio track on the videodisc, the audio is unchangeable. The introduction of synthetic speech into the interactive system eliminates some of this problem. I found the use of synthesized speech beneficial in several areas. I used synthesized speech to tell the participant about differences in the camera which was used on the videodisc and the camera which the participant could manipulate. I used synthesized speech to provide still-frame audio information for definitions. I also used synthesized speech to provide examples which were not on
the videodisc. For example, the audio on the videodisc stated that an ASA index number of 400 was a very light sensitive film. Through synthesized speech, I provided the information that an ASA index of 400 was the recommended film to use for taking indoor photographs.

- **Use text rather than synthesized speech to offer explanations or important introductory material.**

Just as you should not use video simply because you have it, you should not use synthesized speech for its novelty. It can be difficult to understand, and it can get very monotonous very quickly. I tested presenting several lines of opening information through both synthesized speech and text presented on the monitor. When asked, participants greatly preferred the text presentation to the synthesized speech presentation.

Generally, instructions will only be presented once. Text will give the participants the opportunity to read any instructions repeatedly, and is less likely to be misunderstood.

- **Offer the participants the opportunity to turn off the synthesized speech.**

During the development of this instructional unit, I listened to the synthesized speech present the same
information many times. Several of the participants who assisted in the formative evaluation also listened to the synthesized presentation repeatedly. Many asked for the option to turn off the synthesized speech. If such an option is provided, however, make them aware that if the synthesized speech is turned off, some information will not be available.

I found that the following design considerations affected how I designed the interactive lesson. These considerations were due primarily to the equipment and authoring system which I was using and may not exist using other interactive systems in conjunction with synthetic speech.

- **Put the participant option to use synthesized speech before the introduction so that initialization of the system will not interfere with participant concentration and flow of the program.**

In allowing the participant the opportunity to use the synthesized speech, the system must initialize the hardware which creates the synthesized speech. This takes approximately fifteen seconds, which seems to be a very long time when you are watching a blank computer screen. This combined with the initialization of the videodisc player and the memory check on the computer takes about
forty-five seconds. When you are waiting, this seems to be a very long time to wait.

In testing this option, I found that participants who watched the introduction and then had to choose the speech option made negative comments about having to wait for the system to initialize. When all of the initialization occurred at the same time, I received no negative comments.

- You can not have synthesized speech read text which is to appear in your interactive program. The PILOT call to use the synthesized speech will clear a text screen, but not a video screen.

My interactive lesson was programmed in PILOT, which is an authoring language often used to develop interactive lessons. The use of synthesized speech in conjunction with the PILOT programming language, however, created several constraints which should be discussed. I attempted to have the synthesized speech read text which concurrently appeared on the screen and found that, due to the nature of the language, this was not possible.

- If your interactive program is large, the amount of synthesized speech you can use will be small.

A second constraint arose due to the amount of floppy disk space. The Pascal computer program, which accessed
the Voice Communications Adapter and contained the text which was to be spoken utilized 12k to 15k of disk space. This limited the amount of synthesized speech which could be used with the interactive lesson. My interactive program was extensive and I used a dribble file. I could only use fifteen to twenty still frames with synthesized audio.

- Use of speech with a still frame visual causes a text-to-video flicker when you return to a computer text screen after using synthesized speech.

When returning to a text screen from synthesized speech, the frame number appears, and a text-to-video flicker occurs. I have found no cure for this glitch. The use of an authoring language other than PILOT may eliminate this problem.

SUMMARY

There exists today a great amount of instructional material available on interactive videodisc. However, as a result of several factors, such as cost and inherent videodisc design considerations, much of this valuable information is not being used in to its full extent in instructional settings. Through repurposing of an interactive videodisc, many of the negative factors in the presentation of information can be reduced or eliminated.
and benefits can be enhanced. This study was therefore designed to develop those design considerations and guidelines which could be utilized in the repurposing of an interactive videodisc.

The ability to extensively test and modify the interactive lesson during the development stage appears to be one factor which should be emphasized, yet which is too often, due to temporal or economic reasons, overlooked. The extensive formative evaluation available for this study provided the opportunities to discover the most efficient, most effective, and most educationally beneficial methods of interactive videodisc system design. The formative evaluation allowed for testing of any ideas or methods of presentation. In addition, the evaluation allowed for the correction of mistakes, both in programming and in system interaction with the participant.

The use of interactive videodisc technology will continue to grow as videodiscs become more available. In addition, as the costs decrease, more schools and universities will be developing interactive videodisc materials for their own use. Through repurposing, this interactive instructional material, with its wealth of information, can be shared and utilized by a much wider audience. By following the guidelines presented in this study, instructional systems which use repurposed
interactive videodiscs can be developed which best utilize the materials available on the videodisc.

These design considerations provide the basis for the repurposing of videodiscs. Other instructional materials, however, are often utilized in educational settings. Through the use of the repurposing guidelines discussed in this chapter, a model was developed which illustrates the inclusion of these repurposed materials into a typical instructional system design (Dick and Carey's system approach model). This will be further discussed in Chapter 4.
CHAPTER 4

TOWARD AN ADAPTED SYSTEMS DESIGN MODEL
FOR INSTRUCTIONAL DEVELOPMENT

This study was conducted primarily to discern ways of adapting traditional instructional design models to better guide educators whose most typical design problem is one of "repurposing" commercially available materials to meet already established instructional needs. The problem of using existing materials, such as textbooks, films, practice manuals or videodiscs, to satisfy established goals and objectives is considered in this study to be a uniquely different situation than was envisioned in those cases where designers use systems approaches to develop complete instructional packages front to back. The argument was advanced in Chapter 1 that, in fact, very little design work occurs in typical school settings which follows the traditional systems approach, illustrated by models such as Gagne and Briggs (1979) or Dick and Carey (1985). Central to such models is the proposition that the instructional process itself, when properly designed, is very much a complete system where each component has a specified purpose and the various components interact.
together to produce desired results. Indeed, much research is available to show the deleterious effects of instruction designed without regard to a certain harmony between components such as objectives, tests, instructional strategies and materials, or learner needs. Most educators find little fault with the ideal expressed in current design theory and philosophy, that good instruction represents a delicate balance between materials, learning environment, teachers, objectives and so forth. Yet, most educators will find this ideal version of design work difficult to satisfy, and indeed, rarely do teachers, curriculum specialists and others have the opportunity (with appropriate resources) to design instruction "according to the book".

The purpose of this chapter is to propose an alternative to existing models - an alternative which hopefully will represent more fairly the design situation faced by many educators working today in public supported educational environments. In the previous chapter, a practical example was presented in which the designer was able to create an effective interactive instructional unit using an "off the shelf" videodisc and readily available hardware and programming techniques. Methodologically, the design process was carefully documented and analyzed using qualitative techniques. Procedurally, two phases of the
analysis resulted. The first was designed to show in practical terms what the designer did, and how certain design issues were solved. This resulted in the design "guidelines" revealed in Chapter 3 for the example using interactive video. Phase two continues this inductive approach with a more general analysis showing changes which might be made to existing design models, specifically the Dick and Carey (1985) systems model which is typical of many others. Essentially, a new design procedure will be proposed which presumes the designer engages in a design juggling act which is quite different from the traditional systems work.

THE ADAPTED MODEL

Figure 4 represents one attempt to reconcile the repurposing experience, introduced conceptually in Chapter 1 and detailed narratively in Chapter 3, with the typical design scenario expected when one follows the traditional model such as the model constructed by Dick and Carey (1985). Figure 4a describes five considerations for repurposing which deserve special attention in this analysis:

1. First, it is clear that much design work, especially related to repurposing, actually begins somewhere in the middle of the typical design sequence. In these cases, for example, goals and
Adapted Repurposing Model

Figure 4

Adapted Repurposing Model
Considerations for repurposing

1. Inspection of available materials. Attempt to find materials which will satisfy the intent of existing goals and objectives.


3. Effective utilization of selected materials. Awareness of information which is available in selected materials and how those materials match goals and objectives.

4. Reconstruction of selected materials into instructional unit. Formative evaluation as major task as materials are developed into instructional unit.

5. Development of additional materials, such as remedial information, elaborative information, or test items. This material is integrated into selected materials.

Figure 4a
Summary of Adapted Repurposing Model
objectives will already exist when the designer enters the picture. These goals and objectives may or may not be based upon legitimate needs assessment strategies and goal analysis procedures. What the designer is looking for in those cases is instructional material, already produced, which can satisfy the intent of the existing goals and objectives. The first step, therefore, is inspection of existing materials. In the example used for this study and presented in Chapter 3, available videodiscs were inspected and then selected for further analysis.

2. Stage two begins with an attempt to determine the potential value of available material (videodiscs in this study). It is in this stage where the concept of "repurposing" begins to take shape. Essentially, the designer will begin a matching process, looking for compatibility between what is available in the existing materials and the goals and objectives of the instructional unit. Once this preliminary matching process has been completed, the videodiscs or other materials which are selected will be modified for the precise use intended.
3. Because a great deal of commercially developed material is available, the designer must decide how to most effectively utilize the materials which have been selected. Such decisions require an acute awareness of the desired goals, objectives, and intended audience for the instructional unit as well as an acute awareness of the information which is available in the selected materials. In the photography project developed for this study, for example, one goal of the instructional unit was to have the students name essential parts of a camera. The analysis of the videodisc completed for this study involved a search for visual information which best presented the various camera parts. With videodiscs, this analysis can become somewhat challenging since the videodisc typically includes a combination of motion sequences, still-frame visuals, and audio information. As the instructional unit is reconstructed based upon a variety of objectives, perhaps not emphasized during initial development, the designer may be faced with taking the material apart, bit by bit, and then putting new instructional sequences together that make sense.
4. Once the desired materials have been located, the appropriate information from those materials should be matched with the goals and objectives of the unit being developed. The selected material must then be reconstructed or designed into a new, cohesive, understandable instructional unit. The design steps discussed in Chapter 3 which allow the designer to fully utilize the available materials, should be helpful in the development of an instructional unit. There is one particular point that should be equally noted: formative evaluation will enable the designer to refine both the lesson and the presentation of the selected materials. The use of extensive formative evaluation, although time consuming, will allow the designer to adapt, modify, and clarify the individual sections of the instructional unit as well as improving the overall presentation of the unit itself.

5. Finally, information and material needed for the instructional unit which does not exist in the selected materials must be produced through other means (e.g., computer graphics or text, hard copy information, synthesized speech). Information which can be used for remedial purposes, materials
which can be used for elaboration, and test item information is typical of the various types of information which often must be developed for an instructional unit which utilizes existing materials. Any material, however, which is to be designed for a specific instructional unit will require designer time. The time spent, however, in the development and evaluation of these materials which assist in presenting the desired information is needed and should be incorporated into the time planned for a system design.

Figures 4b, 4c, 4d, 4e, and 4f serve to illustrate the relationship between the guidelines presented in Chapter 3 and the overall design caveats described above. The remainder of this chapter is devoted to a more detailed analysis of these figures and to how the expanded or augmented model might work.

**USING THE ADAPTED MODEL**

**Beginning the design work.** As is noted in Figure 4a, the designer operating within a repurposing model assumes that certain design decisions have already been made. Goals and objectives, entry behaviors, and characteristics of learners may have already been described, either by the
1. Select available materials using predetermined unit goals and objectives.

Figure 4b
Inspection of Available Materials
2. Match the information available with unit goals and objectives.

Figure 4c
Matching materials with goals and objectives
3. Select information which best presents desired concepts and determine presentation method(s) of information.

Figure 4d
Utilization of selected materials
4. Reconstruct the selected material into the instructional unit.

Figure 4e
Reconstruction of selected materials
5. Create and incorporate additional materials into instructional unit.

**FORMATIVE/SUMMATIVE EVALUATION**

Instructional Unit

![Diagram](image)

- Intro-Segment No. 1
- Segment #2
- Need Test Items
- Test Item Bank
  - 1. silkjadsf
  - 2. weoisdfj
  - 3. woeij
  - 4. sdikjl
  - 5. woirjoidfj
  - 6. jdark jkddfj
  - 7. jcdnik
  - 8. jkdjikd jsf

- Computer Graphic #1
- Segment #6
- Hard Copy #1
- Segment #2
- Segment #5
- Computer Graphic 2
- Need Remedia Material
- Remedial Materials:
  - Computer Program #1
    - 10 hrs
    - 20 x - 50
    - 30 y = 90
  - Handout #1
    - The first time that
      the new

**Figure 4f**

Development of additional materials
current designer or through instructional planning, and these are brought into the model. Such a beginning represents a typical design scenario in many educational settings. This "beginning in the middle" concept contrasts significantly with existing design models. Instead of beginning with the development of goals and objectives, which is typical in most systems design models, the designer enters into the adapted systems design with existing goals and objectives already in mind (often mandated). The designer's problem is how to find/create instructional materials which match those goals. Often, the designer will have access to a wide variety of materials, yet these materials may not directly address the lesson or the unit objectives. It then becomes necessary for the designer to select that information from the materials which best matches the goals and objectives of the instructional unit. These materials may be initially selected from recommendations presented in written reviews, from word-of-mouth, from personal examination, by previous experience with the materials, or through an intuitive selection process. As this initial selection of materials is a major factor relating to the completed product, one possible improvement in this method of materials selection would be the development of insightful, detailed reviews of commercially developed
instructional materials. In addition, the producers of commercially available instructional materials must be made aware of potential uses of their material, and accordingly design and develop better materials which can meet the changing nature of instruction.

Matching materials with goals. Conscious of the original lesson goals and objectives, the designer examines the selected materials looking for information which matches those goals and objectives. The lack of information in those materials may eliminate the use of those specific materials completely. The designer should be aware, however, that any materials which can not be found must be developed for the instructional unit. This issue of selection versus development of instructional materials should not be an either/or situation. The designer must be fully aware that instructional materials may be selected both from existing materials and/or developed by the designer to meet the needs of the students. It may be that, after locating and viewing available materials, the designer makes a conscious decision to alter the existing goals or re-orient the lesson objectives. These design decisions are often based upon knowledge of instructional design processes, expert advice on information which should be included in an instructional lesson, and designer knowledge of the
development of computer assisted instructional systems. The ability to make these design decisions may, in fact, be assumed on the part of an instructional systems designer.

**Finding the best materials**

During the designer examination of the selected materials, the location of each general concept available in the material is noted, thereby creating a concept map which can be used during the lesson design to locate desired information. For example, in this study, the use of videodisc allowed for the notation of the beginning and ending frame numbers of each of the segments contained on the videodisc. This procedure of mapping the materials is shown in the second design guideline (See Figure 3b). The designer, by means of a matching of lesson goals and objectives with the information available in the materials, must decide which information is to be utilized. In relationship to the Dick and Carey model, this mapping would be an extension of the development of instructional materials and would be influenced by the developed goals and objectives. One possible future enhancement of instructional materials could be an inclusion in the form of an outline or a detailed summary of the information available in those materials. In the case of videodisc information, a detailed listing of information presented on the videodisc along with beginning and ending frame numbers
for each video segment would prove to be time-saving. In addition, this concept map would prove to be very beneficial to the designer who wishes to use materials for instructional purposes other than the ones for which they were originally developed. One example noted, the NASA science videodiscs, contains visual and audio material which could be used in a variety of instructional settings such as math classes or reading labs.

If the selected materials do not contain the information which is needed, the designer has several options. If the materials do not meet the original goals or have sufficient information which is consistent with the goals of the instructional unit, the designer can either select additional materials for evaluation or develop the needed materials. If the supply of available materials has been exhausted, and there is not enough time to develop new materials, the designer should return to a standard design model (such as the Dick and Carey) and select another instructional strategy, such as lecture.

Use of available material. Once the designer has selected the information which best presents the concepts of the instructional unit, a process of reconstruction begins. Ideally, the designer has attempted to select as much usable information from the available materials as possible, as this will reduce the amount of additional
materials which must be developed by the designer. The selected materials can now be utilized in the actual lesson itself.

As noted above, much lesson design which takes place in educational settings is inherently based upon designer intuition. The use of selected materials will vary based upon type of information which needs to be presented, and type of information which exists. For example, if a designer has a textbook which discusses the Civil War, and a film which discusses weapons used throughout the ages, a combination of the two may be used to illustrate the types of weapons used in the Civil War. The amount of material selected from each media will vary depending upon both the information present and the designer's perception of the importance of the presented information. This reconstructive use of both medium, however, will most likely enhance the presentation of the information. The designer can improve this enhancement through the use of formative evaluation during this reconstructive phase of the instructional design.

As each section of the instructional lesson is developed, the designer should have the material reviewed by members of the target audience. This formative evaluation allows the designer to note possible misunderstandings or to improve upon information which is
not being clearly understood. In addition, if equipment or unfamiliar materials are being used, the designer can actually see how that equipment is approached by the student and provide instruction accordingly. For example, in the instructional lesson developed for this study, interactive videodisc equipment was being utilized. As a result of formative evaluation with actual students, implicit instructions were developed which led the students through the steps needed to operate the equipment. This, in turn, made for a more user-friendly environment (as was noted in Chapter 3).

Development of additional materials

The designer should now determine if additional materials are needed. These materials may be needed for several reasons: to present concepts not available in the existing materials; for remedial purposes; as examples; or to present as test items (See Figure 3d). If no additional materials are needed, then the designer has completed the adapted model and may continue with revisions and formative-summative evaluations. If additional materials are needed, and the remainder of the existing materials is inappropriate, the designer must select or create additional materials to incorporate into the instructional lesson. The designer returns to the selected design model and continues with the development of materials. As noted
above, this new materials development is very often intuitive on the part of the instructional designer. For example, Merrill (1983) lists several conditions (such as timing and feedback) which should be utilized when developing test questions for an instructional lesson. Few designers have the time to create tests according to Merrill's exemplary recommendations. This situation is often repeated in the development of materials for instructional use. It is in this development of additional materials, however, that the new technologies which are rapidly becoming available can be of invaluable assistance to the instructional designer.

For example, with the use of interactive videodisc technology, the designer can overcome possible videodisc limitations. If the visual material on the videodisc is clear and adequately presents the information, but the audio information which is presented with the information is inappropriate (the information is incorrect, outdated, or is not specific enough for the concepts which need to be presented), the designer may select between two types of visual presentation. If motion sequences are desired, the designer may present the video followed by text or synthesized speech which presents the necessary information. If still-frame video is appropriate, then the still-frame can be presented with synthesized speech which
presents information that a) explains the still frame video, b) updates or corrects the audio track, or c) elaborates or adds to the audio track information. Other technologies, such as text overlays over visual information and the ability to digitize speech, may also be employed. This ability to alter existing materials which were previously unchangeable has added a new dimension to the concept of selection and development of instructional materials.

USING THE MODEL: AN EXAMPLE

The following example is based upon the lesson design and model which was used for this study. Each of the major aspects of videodisc repurposing have been identified and discussed in view of the developed interactive lesson. As each aspect is developed, it becomes apparent that the sections both build upon one another, and allow for the adaptation of the development of the instructional materials.

Entering the system. The designer had decided to develop an interactive videodisc lesson which will present information needed by beginning photographers. Goals and objectives for the instructional unit were developed through the use of photography experts and information obtained from several introductory books on photography. A
videodisc which contains information relating to photography was purchased from a videodisc supply house. This videodisc was chosen as a representative sample of videodiscs which are available through the market today. It is not a generic videodisc; it contains instructional materials which have been previously developed for a specific audience and a specific purpose. The use of this typical videodisc merely serves as a medium for the much larger adaptive design problem. As a typical videodisc, this allowed for the development of an instructional lesson which would illustrate both the potential of an adaptive design model and the solution to the design problem.

Mapping the videodisc. The designer, keeping the original goals in mind, viewed the photography videodisc and created a map (discussed in Chapter 3) for each concept which appeared to be applicable to the lesson goals and objectives. The goals and objectives of the instructional lesson were matched with the material available on the videodisc. This matching showed that the material on the videodisc did meet and cover the lesson goals and objectives. Where a discrepancy existed, such as the difference between the camera on the videodisc and the camera the participants could manipulate, a decision was made to utilize synthesized speech and still-frame visuals to make the presented information more applicable to the
equipment in use. This decision was tested, found to be beneficial to the participants, and subsequently utilized in the interactive lesson.

**Presentation of the information.** Utilizing the map of the videodisc, and based upon the goals and objectives of the lesson, appropriate visual materials were selected for each concept which needed to be presented. For example, as the effect of the various lenses on light entering the camera needed to be shown, a motion sequence which demonstrated this concept was chosen. When the location of the rewind button needed to be displayed, a still-frame which showed a highlighted rewind button was displayed. The audio track was selected (two audio tracks existed on the videodisc: one intended for beginners, the other for more advanced photographers); audio track one was selected as the audio track which best related to the intended audience. The selected audio track was transcribed and the synchronization of the audio track with the video material was checked; several instances were found where the visual track and the audio track for a specific concept did not begin or end on the same frame. This step was repeated until all available material which had appropriate audio and visual information had been mapped and transcribed for use by the programmer.
Development of additional materials. After all information with appropriate visual and audio tracks was obtained from the videodisc, additional visual materials (information with inappropriate audio tracks; terminology and vocabulary were directed towards a more experienced audience) were selected from the videodisc. Visual materials were chosen to use in the presentation of concepts which had not yet been covered, as remedial materials, and for use in the presentation of definitions. For example, as some differences existed between the camera on the videodisc and the participant's camera, still-frame visuals with synthesized speech audio were used to present information which described these differences. Still frames which displayed desired camera parts or photography concepts were selected and the designer created synthesized speech material which explained the still-frame visual information. In the lesson, this synthesized audio information was presented with the appropriate still frame visual. The formative evaluation during the development of the instructional unit indicated that the videodisc information did not provide adequate definitions for photographic terms, either in audio or visual form, so additional definitions were developed (using information from the second audio track, and books on photography) and were presented in the lesson. Once the videodisc material
which covered the concepts was incorporated into the interactive lesson, the design of the interactive lesson then returned to the original design model for development of test questions, development of materials which were not to be presented through videodisc, revision of instruction, and formative and summative evaluation.

CONCLUSIONS/RECOMMENDATIONS

In many educational situations, the need for the development of instruction carries with it several important caveats: the instruction which is to be designed must be based upon certain existing goals and objectives. These goals and objectives may be state mandated, may be determined through single school implementation, or may be based upon the perceived needs of an existing group of students. These goals and objectives, which are an integral part of instructional design and development, have been placed into the hands of the designer and instruction must be developed which incorporates these goals and objectives.

This study has shown the need for the creation of an adapted design model for the development of instructional materials. Through the use of a videodisc-based instructional environment, an interactive lesson was developed which formed the basis for the creation of this adapted design model. This adapted design model addresses
the development of instruction which is created utilizing existing goals and objectives. By means of an analysis of the design steps and participant feedback, design decisions which led to the creation of guidelines were monitored and evaluated. These guidelines, in turn, were utilized in the development of the adapted design model presented in this study. This adapted design model was incorporated into a standard design model (the Dick and Carey model of instructional design), showing the appropriate steps to be followed for the creation of instruction.

Previous design models, such as Dick and Carey, do not address the scenario of entering into a design situation with existing goals and/or objectives. With the Dick and Carey model, the development of goals and objectives form a substantial portion of the instructional design scenario. More often, however, a teacher or designer will enter into the development of instruction with existing goals and objectives which must be utilized as the basis for an instructional unit or lesson. This study has provided for that person a starting point from which to begin the development of instruction.

This study has attempted to show, through the utilization of an interactive videodisc instructional framework, that existing design models do not adequately
represent situations which have resulted from technological developments. But it has raised questions which should be studied and answered through further research. The utilization of this design model should be implemented and tested in other settings and using other videodiscs. The validation and refinement of the adapted design model must also be conducted in both an interactive videodisc environment as well as other instructional environments. Further developments, (for example, in both the presentation and storage methods of information), will require the development of instructional design models which reflect the utilization of these technological advances. Existing design models provide a strong, well-tested foundation from which to proceed with instructional design. Designers of instruction must, however, have the ability to adapt these models to reflect the changes which technology will inevitably bring. It is through this adaptability that instructional design will be able to benefit both from the strengths of existing design models and the potential of new technologies.
REFERENCES


APPENDIX A:

SELECTED EXAMPLES OF AVAILABLE VIDEODISCS
## APPENDIX A

### SELECTED EXAMPLES OF AVAILABLE VIDEODISCS

<table>
<thead>
<tr>
<th>TITLE</th>
<th>AREA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Philip Pearlstein Draws the Artist's Model</td>
<td>Art</td>
</tr>
<tr>
<td>Birds of North America</td>
<td>General</td>
</tr>
<tr>
<td>Space Disc 1 (Voyager)</td>
<td>Science</td>
</tr>
<tr>
<td>Space Disc 2 (Apollo)</td>
<td>Science</td>
</tr>
<tr>
<td>Space Disc 3 (Shuttle)</td>
<td>Science</td>
</tr>
<tr>
<td>Space Disc 4 (The Sun)</td>
<td>Science</td>
</tr>
<tr>
<td>Space Disc 5 (Astronomy)</td>
<td>Science</td>
</tr>
<tr>
<td>Space Disc 6 (Earth Science)</td>
<td>Science</td>
</tr>
<tr>
<td>Space Archive</td>
<td>Science</td>
</tr>
<tr>
<td>Life Science 1</td>
<td>Science</td>
</tr>
<tr>
<td>Life Science 2</td>
<td>Science</td>
</tr>
<tr>
<td>Mars and Beyond</td>
<td>Science</td>
</tr>
<tr>
<td>Apollo 17</td>
<td>Science</td>
</tr>
<tr>
<td>Greetings from Earth</td>
<td>Science</td>
</tr>
<tr>
<td>Space Shuttle</td>
<td>Science</td>
</tr>
<tr>
<td>Basic Chemistry for Biology</td>
<td>Biology</td>
</tr>
<tr>
<td>BioSci Disc</td>
<td>Biology</td>
</tr>
<tr>
<td>College USA</td>
<td>General</td>
</tr>
<tr>
<td>Computer Literacy</td>
<td>Computers</td>
</tr>
<tr>
<td>Earth Science (3 discs)</td>
<td>Science</td>
</tr>
<tr>
<td>First National Kidisc</td>
<td>General</td>
</tr>
<tr>
<td>Fun &amp; Games</td>
<td>General</td>
</tr>
<tr>
<td>Heart &amp; Circulatory System</td>
<td>Biology</td>
</tr>
<tr>
<td>History DisQuiz</td>
<td>History</td>
</tr>
<tr>
<td>Introduction to Economics</td>
<td>Economics</td>
</tr>
<tr>
<td>Knowledge Disc</td>
<td>General</td>
</tr>
<tr>
<td>Learning about Occupations</td>
<td>Vocational</td>
</tr>
<tr>
<td>Life Cycles</td>
<td>Biology</td>
</tr>
<tr>
<td>Mastering Decimals and Fractions</td>
<td>Math</td>
</tr>
<tr>
<td>Mastering Fractions (3 discs)</td>
<td>Math</td>
</tr>
<tr>
<td>Mastering Ratios (3 discs)</td>
<td>Math</td>
</tr>
<tr>
<td>Math Assessment</td>
<td>Math</td>
</tr>
<tr>
<td>Math in Biology</td>
<td>Math</td>
</tr>
<tr>
<td>Music Is (5 disc set)</td>
<td>Music</td>
</tr>
<tr>
<td>National Air &amp; Space 1</td>
<td>Science</td>
</tr>
<tr>
<td>National Air &amp; Space 2</td>
<td>Science</td>
</tr>
<tr>
<td>National Air &amp; Space 3</td>
<td>Science</td>
</tr>
<tr>
<td>National Gallery of Art</td>
<td>Art</td>
</tr>
<tr>
<td>Physics and Auto Collision</td>
<td>Physics</td>
</tr>
<tr>
<td>Shuttle Downlink</td>
<td>Science</td>
</tr>
<tr>
<td>Study Skills</td>
<td>General</td>
</tr>
<tr>
<td>Tacoma Narrows Bridge Collapse</td>
<td>Science</td>
</tr>
<tr>
<td>Videodisc in Science</td>
<td>Science</td>
</tr>
<tr>
<td>TITLE</td>
<td>AREA</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>------------</td>
</tr>
<tr>
<td>Villa Alegre</td>
<td>Language</td>
</tr>
<tr>
<td>Vincent Van Gogh</td>
<td>Art</td>
</tr>
<tr>
<td>Whales</td>
<td>Science</td>
</tr>
<tr>
<td>World of Work</td>
<td>Vocational</td>
</tr>
<tr>
<td>Anatomy and Dissection of the Frog</td>
<td>Science</td>
</tr>
<tr>
<td>Applied Industrial Mathematics</td>
<td>Math</td>
</tr>
<tr>
<td>Building Financial Service Relationships</td>
<td>Vocational</td>
</tr>
<tr>
<td>The Business Disc</td>
<td>Vocational</td>
</tr>
<tr>
<td>ETS &quot;Preparing to take Standardized Tests&quot;</td>
<td>Testing</td>
</tr>
<tr>
<td>Electronic Theory Training</td>
<td>Science</td>
</tr>
<tr>
<td>General Mathematics</td>
<td>Math</td>
</tr>
<tr>
<td>Improving Teacher Effectiveness</td>
<td>Training</td>
</tr>
<tr>
<td>Industrial Machining and Fabrication</td>
<td>Vocational</td>
</tr>
<tr>
<td>IV Music Series</td>
<td>Music</td>
</tr>
<tr>
<td>Introduction to Computer Literacy</td>
<td>Computer</td>
</tr>
<tr>
<td>Introduction to Lotus 1-2-3</td>
<td>Computer</td>
</tr>
<tr>
<td>Laser Learning</td>
<td>Language</td>
</tr>
<tr>
<td>Living Textbook Packages (5 discs)</td>
<td>Science</td>
</tr>
<tr>
<td>Papermaking: The Process and the Product</td>
<td>Science</td>
</tr>
<tr>
<td>Passport to your Future</td>
<td>General</td>
</tr>
<tr>
<td>Pathfinder</td>
<td>General</td>
</tr>
<tr>
<td>PC-DOS and System Operation</td>
<td>Computer</td>
</tr>
<tr>
<td>Profiles in American Art</td>
<td>Art</td>
</tr>
<tr>
<td>SETS Interactive Personal Computing</td>
<td>Computer</td>
</tr>
<tr>
<td>The Training Solution</td>
<td>Computer</td>
</tr>
<tr>
<td>Trigland: An Interactive Video Perspective</td>
<td>Math</td>
</tr>
<tr>
<td>Video Based Training for Personal Computing</td>
<td>Computer</td>
</tr>
<tr>
<td>National Geographic (Land of the Tiger)</td>
<td>General</td>
</tr>
<tr>
<td>National Geographic (Iceland River Challenge)</td>
<td>General</td>
</tr>
<tr>
<td>National Geographic (Gorilla)</td>
<td>General</td>
</tr>
<tr>
<td>National Geographic (The Incredible Human Mach)</td>
<td>General</td>
</tr>
<tr>
<td>National Geographic (The Sharks)</td>
<td>General</td>
</tr>
<tr>
<td>National Geographic (Yukon Passage)</td>
<td>General</td>
</tr>
<tr>
<td>Vietnam, The 10,000 Day War (3 discs)</td>
<td>History</td>
</tr>
<tr>
<td>35mm Photography</td>
<td>Photog.</td>
</tr>
<tr>
<td>The Creative Camera</td>
<td>Photog.</td>
</tr>
<tr>
<td>Gardening at Home</td>
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</tr>
<tr>
<td>The Greatest Adventure</td>
<td>General</td>
</tr>
<tr>
<td>Hearts and Minds: The Vietnam War</td>
<td>History</td>
</tr>
<tr>
<td>LaMaze Childbirth Techniques</td>
<td>General</td>
</tr>
<tr>
<td>Space Ace: Laser Disc from the Arcade Game</td>
<td>General</td>
</tr>
<tr>
<td>Cliff Hanger: Laser Disc from the Arcade Game</td>
<td>General</td>
</tr>
<tr>
<td>Victory at Sea (4 discs)</td>
<td>General</td>
</tr>
</tbody>
</table>

This list was compiled from various videodisc catalogues.
APPENDIX B:

SAMPLE TRANSCRIPT
Transcript - Tape 1

March 9, 1987
7:30 pm

Note: --- is indicated where I was reading from the script.
The letters which appear beside the remarks refer to the taxonomy. For example, KPb refers to a KEYWORD categorization and the PLANNING/ORGANIZATION category, subcategory B.

Na What I'm gonna do now is go through Chapter 2, both audio tracks and focus on information that I feel will need to be included.

Pb Primarily, I will be going through and marking out stuff that I don't think will fit, or really won't be needed.

Nb OK I'm on chapter 2, audio 1.

---

L Audio 1 is intended primarily for the novice. And audio 2 is intended more for the expert.

---

Pb All this sounds like good introductory material.

---

Kb OK. It seems like some of these words I'll need to emphasize as keywords, like lens barrel. It will probably be a still frame or a audio track. I'm underlining it.

---

Nb That sentence is not really needed. It is information which is just redundant.

---

K That's another keyword that I think will need to be understood.

---

Pb That sounds like a good place to have them, to have the camera in their hand and so I'm putting down camera in hand. I think that will help them to manipulate that.

---

EaPb I was just thinking this seems like it needs to be elaborated. I may want to expound here. So I am going to put a circle s for sound. I'll put that up at the top of the paper. Circle s equals sound, just to remind myself.

---
OK, that's another word I don't know if they understand it. I'll have to look and see what the video does there to make sure they understand the concept of viewfinder.

---

Another word that I think we'll need to understand, so I'll underline it.

---

OK, evidently they've talked about f-stops in a previous lesson, although this is chapter 2. I'll have to go back and check lesson 1 to see if they discussed f-stop in lesson 1.

---

I'm just wondering if the amount of information where, how much information should I present in one piece? I think I'll need to go with seeing the audio with the video, combined.

---

This will have to be eliminated since the people using the lesson won't have the capability to do the still steps, so it's mentioned f-stop being a new photographic term. I'm looking in, I'll have to go in and put the information found in the disc jacket in either on a still frame or graphics on the computer. That would be a good place to break for some information.

---

OK, it talked about aperture control, but it doesn't flow very well so I may need to put something.

---

Again I need to see this with the video.

---

And I'm marking things, like I normally do, that I can't understand. I put two carets that make any sense of the video.

---

Two words that again I'll need to make sure that they can find on their camera.
OK, this is an example.

OK, I'm going back up now. I've just noticed that I put two brackets. I'm going to put omit on the paragraph that uses the still step. I'm going back.

I think I want to add some extra examples, and I'm sure, assume there are some on the video.

What I'm thinking right now is since they won't have the telephoto lens, should I include this information? I put a bracket and question mark. Don't have, include?

I'm wondering, again, are these, is this information necessary for the goals, and what I'm trying to think of what's the goal I'm trying to get out of using this chapter. OK, obviously the goal is teaching about lens, but since they only have one type of lens to manipulate, should I go into talking about the effects that other lenses have? Ok, that's a question over to the side.

Again, I may want to go through if I decide to discuss these different types of lenses and find as many different examples on the disk as I can, which will serve to, as an explanation for these various types of words.

Again, this is information which I don't think, I remember the video for this. It's a bit silly, a bit trite. I don't know if it serves and purpose.

Again, something fairly trite, that I'm not sure is really needed so I'll put a question mark, needed, beside of it.
Again, if I'm going to use these different types of lenses, which I think is one of the purposes of this chapter, I need to make sure that I provide good information, either through video or audio, or still frames or graphics that talk about each kind, so they can make sure they have it marked. It would be good to use an overlay here, if you had it. If the word is not overlaid on the screen, and as best I can remember, I don't think it is.

---

So, I went through chapter 1, and found only really one thing I would eliminate, and that was the still step, which I eliminated primarily because they didn't have the capability to do that, although I guess I could include that in the manual, but all they'll be doing in the program, but all they're really doing is tell them to go look up a definition and I could put that graphically on the screen.

Other questions I had were to add the examples. I had about six words for main words that I feel need some time of elaboration if the video does not elaborate it enough. For example, telephoto lens, wide angle lens, fisheye lens, macro lens. One of the questions I want to go and talk about when I look at the video is are these special effects special enough to include in just a basic lesson on lens use?

[END OF CHAPTER ONE]

Chapter 2, audio 2, is a woman's voice. I'll need to take this into consideration because, if I decide to use speech synthesis, how will the user react to the speech synthesis, which is going to be a male's voice. Chapter 2, again, is intended for a more advanced audience. I have to decide if I want to use the advanced audience text. Also, I have to decide, if the fact that it is a woman's voice is going to affect. I go through and probably do testing using the same video with three different audios and see if it makes any effect. Primarily, I guess the effect I'll be looking for is not whether it makes any effect in learning, because I don't think it will, but whether it makes any effect in how people, if they like it better with a man's voice or a woman's voice or a synthesized speech. I have a feeling when I go through the second audio, I'll probably want to eliminate the same things I eliminated in the audio 1.

Now as I'm going through this, I'll need to keep in mind what I've read in chapter 1, audio 1 and see if I, cause I may want to combine this. I may want to use both the man's and woman's and synthesized speech.

---
I like that introduction. It's clear and it's clean. And what I'm wondering now, looking at it, is, if I have the correct audio, if audio 1 is the man's voice and audio 2 is the woman's voice. I think so.

---

That sounds like an introductory type of idea. But then again, the farther along I read, I see that it starts talking about, again the lenses. I need to go and check the video with the audio and make sure I have the correct ones.

---

SLR would need to be explained. I'm thinking I may want to go through and have, give them the capability at certain spots to ask for these definitions. I don't know how I'll go through and incorporate that, right now, but I seem to remember Shelly did it with theirs, some places, though they did theirs on the graphics screen, but, like if the word was green, red, or white, they could ask for a definition. They need to do that as an introduction before I go into each lesson, to make sure, and that would be a good prompt, to make sure they have the words understood. I could give a text definition and a video definition at the same time. I could go through and do something like: You need to understand the following terms, for you will have the following terms in this unit. Present the terms either textual or visually and then go back and run through the lesson. That's a good idea! And so, what again, all the words I've underlined, I may want to do that with.

---

Again, words like aperture, SLR, viewing system, are the types of words I need to display.

---

I'm underlining focus indicator. Any words that I don't know off the top of my head, that seem to be photographic terms, are the words that I would identify.

---

I was just looking through on audio 1, it told you to stop the film. I don't see this, those disc stops, in audio 2, which is strange.
That's not very clear. I wonder how the video goes through.

That's a good analogy. I may want to use it. I may want to take some of the audio track and present it through synthetic speech rather than switch back and forth between the man's and woman's voice.

Again, this seems like, it definitely does need video to go with it.

If I do decide to use chapter 2, I would eliminate this, because it just sounds too wordy.

I like that. That's a good sentence. I like the way they explained that.

That's semi-important. Why is it semi-important? It just doesn't seem verbally to make too much sense. I think the way chapter 1 talked about it, they never really talked about it, the only lens they talked about in terms of mm would be a 50mm lens. And so I think it seems like more information than the person would need to know. They just need to know if you have a 50mm lens, it is the same perspective, smaller lens makes its seem far away, bigger lens makes it seem closer. Also it doesn't, as I re-read it, it makes sense but it doesn't sound clear the first time. Because, to make an object 400 yards away, to make it appear only 100 yards away. And you have to go back and relate that 200mm to 50mm, realizing that's four times, which is something, if it's going by auditorially and visually so fast, you really don't have time to do.

Again, that sounds like a very important point, but it's not emphasized verbally or textually. So, if it so important, SO TAKE SPECIAL CARE, I hope the video that goes along with it is, emphasizes it very good.
OK, that's important. I'm going to go back to chapter 1 and see if it talks about, audio 1, zoom lengths, no, it doesn't and again I think I'd want to include. If I decide that focus is a key point.

---

Again, their talking about the streaking effects which are silly on the video.

---

That's something that the user may be interested in, and they talked about it in audio 1, but not in relationships to close-up photography. So, again, another important point, that I may want to identify in a definition or synthetic speech 1. I like this definition in audio 2 better than the definition in audio 1, because audio 1 really doesn't give a good definition. It may be a definition visually, but it would seem like to make the greatest impact you would want both a visual definition and an audio definition. So I may want to do that with synthetic speech, or when I give the definition.

---

Focus ring, a word which needs to be explained.

---

Again, words I'm sure, well I'm not sure, I would assume they talk about or show in the video.

---

There are several things in audio 2 that are much better than audio 1, however, I have to go through and check how they use the video with audio, and go through and find out if I want to use just a man's voice.

[END OF AUDIO 2]

Just some general thoughts:

When I'm going through, I need to make sure that I have clear goal in mind, about what I want to get out. Because I think you can hear when I was going through, I want to get this, I want to show them this. Also, I'm not sure it's going to be really beneficial going through an audio track by itself because several
times I've said I need to see how the video presents this. And also, there may be things again in the video that I want to cut out. I'm just thinking that I can go through and do both at the same time. I may want to go through and do, say for example chapter 3, and do it with audio and video at the same time. And see if it makes a difference.

Again, if not doing them both at the same time, but having the video there that I can refer to may be the best bet.

Just another general idea. I'm wondering how helpful it would be to have the audiotrack for the information on videotape before you get ready to do the material presented. I may go through and do a chapter without the audio track, but that seems like a pretty good idea, just have it written down, so you can actually go through and mark out things, and see things that you need. So that may be another guideline, just to go through and mark things. To have the audio track written out. Now, I don't, if you are going to do an hour lesson, it would take forever to sit and type out these audio tracks, but I guess you want to do an hour lesson, you just have to take the time that it would take to type that out.

Also, in going back and looking through mine, I notice that I've made several marks, that I think I've talked about on the tape. But you may want to go through and devise some sort of system. For example, underline means a word that needs to be talked about, the brackets mean things that need to be eliminated. Things like that. Star for very important information.

I'm wondering if you should go through and time this, if time is going to be of any kind of importance. I don't think it would be, but again, that's just another thought, which you may want to go through and think about.

Now almost every case, you are going to have two different tracks. You may have two different voices, like in this case you have a man's voice and a woman's voice. I wondering the process you will go through to decide which voice to use. Is it necessary to stay with one voice? I think I'll run some tests and see how people react to that. Again, I think that won't be a learning situation, just a preference situation. It may be that you want to use a woman's voice for female students, and a male voice for male students.

[END OF TRANSCRIPT]
APPENDIX C:

PILOT PROGRAM
dx:vipc$(500)
f:0,vipc$
t(vipc$(l)=chr(255)):file vipcpi.bin not found.
dx:x$(500)
f:0,x$
t(x$(l)=chr(255)):file exec.bin not found.
d:nls(25)
d:ans$(4000)
d:stu$(1)
d:$$(l)
c:a = -1
c:b = 0
dc:
tx:
ts:ml$f7;11
**
ts:f3
t:
************
ts:f7
t:

This interactive unit contains some information which can be presented using a synthesized voice.

If you choose not to use the synthesized speech, you will not be able to receive information presented while still frames are presented on the screen.

Would you like the speech option for this unit (Y/N)?

m:Y'y
cy:s = 1
cn:s = 0
j:there
c:x$$(9,80)="set vcapi = b:"
v:x$
c:x$$(9,80)="b:"
v:x$
c:x$$(9,80)="cd \vcapi"
v:x$
c:x$$(9,80)="vcapidrv/o 10"
v:x$
c:x$$(9,80)="a:"
v:x$
j:there
Do You Know Your Camera?

Press the letter of your answer:

YOU MUST USE PLAY NOT PLYB FOR STILL FRAME AUDIO!!!
*name

Type in your name and press <Y.

Is $nl$ your correct name (Y/N)?

M: Y

jn: name
This is an introductory lesson on photography. The photography information will be presented on the screen. You may review information that you wish to see again, or you can skip the information and take the post-test. Please press any key to continue.
If this is the first time you have used this interactive video instruction, you should take the pre-test first.

This will be choice A on the menu which will appear at the end of this introduction.

Please press any key to continue.

Please follow the directions which appear on the screen, and on any computer printouts which you will receive.

Please press any key to continue.

=menu

MENU

A) Take the unit pre-test
B) View Photographic Terms unit
C) View Lens unit
D) View Film unit
E) Choose a section for review
F) Definitions
G) Information about choices
H) Take the unit post-test
Q) QUIT

Press the letter of your choice:

as: stu$s
u:saver
m:F$f
jy:second
m:H$h
jy:postat
jn:menu
Press any key to continue.
This choice allows you to view the unit on the parts and name of the 35mm camera.

This choice allows you to view the unit on lens, focus, aperture.

This section allows you to review the information about film, speed and lighting conditions.

This section allows you to review any selected portion of the unit on photography.

This section allows you to receive either video or text definition for photography terms.

Complete this test when you have finished the entire unit.
Are you sure you want to quit (Y/N)?

You can receive definitions about any of the following words:

A) Rewind Button
B) Focal Plane Shutter
C) Shutter Speed Control Knob
D) ASA/ISO Index
E) Lens Release Button
F) MORE DEFINITIONS...
G) RETURN TO MAIN MENU

Press the letter of your choice:

A B C D E F G a b c d e f g
REWIND BUTTON

This button is used to rewind the film when you have completely shot the roll. It is found on the bottom of most cameras.

FOCAL PLANE SHUTTER

Two overlapping curtains that form a slit that moves horizontally in front of the film plane.

SHUTTER SPEED CONTROL KNOB

This knob is used to control the speed that the shutter opens and closes.

ASA/ISO INDEX

This index is used to set the light meter to the speed of the film which you are using. It is often combined with the shutter speed control knob.
LENS RELEASE BUTTON

A button, adjacent to the lens mount, which releases a locking device that holds the lens securely in place.

Press the letter of your choice:

A) Aperture Setting
B) Focus Indicator
C) Plane of Critical Focus
D) Aperture Control
E) Film Speed
F) Resolution
G) Grain
H) Return to previous definitions
I) RETURN TO MAIN MENU

This is indicated by an f number and tells how big the lens opening will be.
FOCUS INDICATOR

This is the distance in feet (or meters) that will be in focus in your picture. This indicator is found on the lens.

PLANE OF CRITICAL FOCUS

Subjects in the plane of critical focus will be in focus. Otherwise, they will be blurred.

APERTURE CONTROL

This controls two things:
1) Controls the flow of light through the lens.
2) Affects how much of the image will be in focus.
FILM SPEED

The ASA/ISO number indicates the film speed which determines how sensitive a film is to light.

RESOLUTION

The ability of a film to record and define an image in detail.

GRAIN

The apparent texture and pattern of a photographic image.
*wind
  c: begf = 9736
  c: endf = 10130
  u: play
  w: 50
  j(s=0): second
  u: sound
  jn: second
  cy: begf = 9811
  cy: endf = 9812
  uy: play2
  cy: xs(9, 80) = "wind"
  vy: xs
  cy: begf = 9811
  cy: endf = 9812
  uy: play
  j: second

*focal
  c: begf = 10130
  c: endf = 10432
  u: play
  w: 50
  j(s=0): second
  u: sound
  jn: second
  cy: begf = 10235
  cy: endf = 10236
  uy: play2
  cy: xs(9, 80) = "focal"
  vy: xs
  cy: begf = 10235
  cy: endf = 10236
  uy: play
  j: second

*speed
  c: begf = 10460
  c: endf = 11401
  u: play
  w: 50
  j(s=0): second
  u: sound
  jn: second
  cy: begf = 10554
  cy: endf = 10555
  uy: play2
  cy: xs(9, 80) = "speed"
  vy: xs
  cy: begf = 10554
  cy: endf = 10555
  uy: play
  j: second
*index
  c: begf = 12760
c: endf = 13063
  u: play
  w: 50
  j(s=0): second
  u: sound
  jn: second
cy: begf = 12865
cy: endf = 12866
  uy: play2
cy: xs(9,80) = "index"
  vy: xs
cy: begf = 12865
cy: endf = 12866
  uy: play
  j: second

*lens
  c: begf = 13072
c: endf = 13443
  u: play
  w: 50
  j(s=0): second
  u: sound
  jn: second
  cy: begf = 13378
cy: endf = 13379
  uy: play2
cy: xs(9,80) = "lens"
  vy: xs
cy: begf = 13378
cy: endf = 13379
  uy: play
  j: second

*sett
  c: begf = 14850
c: endf = 15360
  u: play
  w: 50
  j(s=0): second
  u: sound
  jn: second
cy: begf = 17150
cy: endf = 17151
  uy: play2
cy: xs(9,80) = "sett"
  vy: xs
cy: begf = 17150
cy: endf = 17151
  uy: play
  j: second
*indc
  c: begf = 15940
c: endf = 16476
u: play
  w: 50
  j(s=0): second
  u: sound
  jn: second
cy: begf = 16400
cy: endf = 16401
uy: play2
cy: x$(9, 80) = "indc"
vy: x$
cy: begf = 16400
cy: endf = 16401
uy: play
  j: second

*plan
  c: begf = 16500
c: endf = 16780
u: play
  w: 50
  j(s=0): second
  u: sound
  jn: second
cy: begf = 16520
cy: endf = 16521
uy: play2
cy: x$(9, 80) = "plan"
vy: x$
cy: begf = 16520
cy: endf = 16521
uy: play
  j: second

*ctrl
  c: begf = 16700
c: endf = 17412
u: play
  w: 50
  j(s=0): second
  u: sound
  jn: second
cy: begf = 17150
cy: endf = 17151
uy: play2
cy: x$(9, 80) = "ctrl"
vy: x$
cy: begf = 17150
cy: endf = 17151
uy: play
  j: second
•press3
ts: g3, 19
ts: f3

•post
l: post

*scorer
c: n = n + 1
e:

*saver
c: a = a + 1
c: b = b + 1
c(s=1): S$ = "Y"
c(s=0): $S = "N"
c: ans$(1, 24) = nl$f c: ans$(25, 1) = S$c: ans$(a+26, 9) = "Choice 2"
c: ans$(a+35, 2) = b c: ans$(a+38, 1) = stu$f c: ans$(a+39, 2) = ""
c: ans$(a+41, 1) = chr(10)
c: a = a + 40

#vidmn

VIDEO REVIEW MENU

A) Introduction to 35mm Cameras
B) The Camera and Film
C) What the Camera Sees
D) Options for my camera
UNIT 2
E) Lens: Focus
F) Lens: Aperture

UNIT 3
G) Introduction to Film
H) Film Speed
I) Film Temperature
J) Resolution and Grain

K) Information about choices
L) RETURN TO MAIN MENU

Press the letter of your choice:

a: A
b: B
c: C
d: D
e: E
f: F
g: G
h: H
i: I
j: J
k: K
l: L

A!a
B!b
C!c
D!d
mj: E'e
  c: begf = 15370
c: endf = 16780
  u: play
  w: 50
  j: vidm

mj: F'f
  c: begf = 16790
c: endf = 17412
  u: play
  w: 50
  j: vidm

mj: G'g
  c: begf = 22800
c: endf = 24658
  u: play
  w: 50
  j: vidm

mj: H'h
  c: begf = 24850
c: endf = 25820
  u: play
  w: 50
  j: vidm

mj: I'i
  c: begf = 25825
c: endf = 27000
  u: play
  w: 50
  j: vidm

mj: J'j
  c: begf = 27000
c: endf = 27720
  u: play
  w: 50
  j: vidm
INTRODUCTION TO 35mm CAMERAS

This section provides an overview about 35mm cameras.

THE CAMERA AND FILM

Describes the interior of the camera, loading and advancing the film, and how the shutter works.

WHAT THE CAMERA SEES

Describes how lenses work and how the image is placed on the film.

OPTIONS FOR MY 35mm CAMERA

Describes the various options which are available for the 35mm camera.

LENS: FOCUS

This section provides an overview on how the 50mm lens (the lens normally found on a 35mm camera) is focused.

LENS: APERTURE

This section describes how the aperture setting and fstop affects how your picture will look.

INTRODUCTION TO FILM

This section describes the various types of film, both color and black and white.

FILM SPEED

This section discusses ASA numbers.
VIDEO REVIEW INFORMATION Page 3 of 3

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**FILM TEMPERATURE**

This section provides an overview of the two types of color films.

**RESOLUTION AND GRAIN**

This section describes important image qualities which are available in various films.

*If you would like more information, you may receive an additional AUDIO description.*

This information will come from the mini-speaker. Make sure that the mini-speaker is turned on.

Press S for the description or any other key to continue.
This is the pretest for the unit:

INTRODUCTION TO PHOTOGRAPHY

There are 20 questions.

The printer should be turned on!

** Question # 1

You should insert a new roll of film into the

A) left chamber of the camera.
B) right chamber of the camera.
C) central chamber of the camera.

** Question # 2

The film guiderails

A) help you load the film into the camera.
B) hold the film firmly in place.
C) are not found on modern cameras.
Question # 3

The notches on the film must be engaged on the take-up roller.

T) True
F) False

Question # 4

The film counter should

A) register 0 when you begin.
B) not register before you take your first picture.
C) register 1 when you begin.

A

C

1
Question # 5

The lens of the 35mm camera

A) should never be removed.
B) removed only for cleaning.
C) can be removed and exchanged for other lenses.

Question # 6

The rewind button is found

A) on the side of most cameras.
B) on the bottom of most cameras.
C) on the top of most cameras.

Question # 7

You should not adjust the shutter speed on your camera.

T) True
F) False
A shutter speed of 'B' is one of the most common speeds used today.

T) True
F) False

The lens on the 35mm camera will allow you to see
A) what the camera sees.
B) 3/4ths of what the camera sees.
C) an inverted image of what the camera sees.

The ASA/ISO index tells you how fast or slow to set the shutter speed.
B) tells how big your final prints will be.
C) is rarely used on today's 35mm cameras.
The aperture setting on a camera determines:

A) how long the film will be exposed to the subject.
B) the amount of light entering the camera.
C) tells you how fast or slow to set the shutter speed.

The focus indicator tells you how much of your image is in focus.

T) True
F) False

The plane of critical focus is used to determine:

A) how much background will be in your photograph.
B) the distance from your camera to the farthest subject.
C) which subjects will be in focus in your photograph.
The aperture control setting controls the amount of light which entering the lens.

T) True
F) False

The aperture control also
A) determines the speed of the film.
B) affects how much of the image will be in focus.
C) controls the shutter speed.

Press True or False

Question # 14

Press A, B, or C

Question # 15
**Question #16**

The film speed is determined by:

A) cost of the film.

B) ASA - ISO index number.

C) amount of light which enters the camera.

**Question #17**

The higher the ASA index the more sensitive the light is to film:

T) True

F) False

**Question #18**

Film temperature refers to the temperature in which you should use the film.

T) True

F) False
Question #19

The resolution of a film refers to:

A) the image which is produced on the film.
B) the texture of a photograph.
C) the amount of light to dark present on a negative.


Press: A

Question #20

The finer the grain of a film the coarser the photograph will appear to be.


Press: F
Introduction to 35mm cameras

The Camera and Film

What the Camera Sees
t(q7 = 1): What the Camera Sees
f0(q7 = 1): 0, "What the Camera Sees"  !! chr(13)  !! chr(10)
c(q7 = 1): q8 = 0
c(q7 = 1): q9 = 0
c(q7 = 1): q10 = 0
t(q8 = 1): What the Camera Sees
f0(q8 = 1): 0, "What the Camera Sees"  !! chr(13)  !! chr(10)
c(q8 = 1): q9 = 0
c(q8 = 1): q10 = 0
t(q9 = 1): What the Camera Sees
f0(q9 = 1): 0, "What the Camera Sees"  !! chr(13)  !! chr(10)
c(q9 = 1): q10 = 0
t(q10 = 1): What the Camera Sees
f0(q10 = 1): 0, "What the Camera Sees"  !! chr(13)  !! chr(10)
t:
t(q11 = 1): Lens: Aperture
f0(q11 = 1): 0, "Lens: Aperture"  !! chr(13)  !! chr(10)
c(q11 = 1): q14 = 0
c(q11 = 1): q15 = 0
t:
t(q12 = 1): Lens: Focus
f0(q12 = 1): 0, "Lens: Focus"  !! chr(13)  !! chr(10)
c(q12 = 1): q13 = 0
t(q13 = 1): Lens: Focus
f0(q13 = 1): 0, "Lens: Focus"  !! chr(13)  !! chr(10)
t:
t(q14 = 1): Lens: Aperture
f0(q14 = 1): 0, "Lens: Aperture"  !! chr(13)  !! chr(10)
c(q14 = 1): q15 = 0
t(q15 = 1): Lens: Aperture
f0(q15 = 1): 0, "Lens: Aperture"  !! chr(13)  !! chr(10)
t(q16 = 1): Film Speed
f0(q16 = 1): 0, "Film Speed"  !! chr(13)  !! chr(10)
c(q16 = 1): q17 = 0
t(q17 = 1): Film Speed
f0(q17 = 1): 0, "Film Speed"  !! chr(13)  !! chr(10)
t(q18 = 1): Film Temperature
f0(q18 = 1): 0, "Film Temperature"  !! chr(13)  !! chr(10)
t(q19 = 1): Resolution and Grain
f0(q19 = 1): 0, "Resolution and Grain"  !! chr(13)  !! chr(10)
c(q19 = 1): q20 = 0
t(q20 = l): Resolution and Grain
fo(q20 = l): "Resolution and Grain" !! chr(13) !! chr(10)
t:
fo:0,"Options for my camera" !! chr(13) !! chr(10)
fo:0,"" " chr(13) !! chr(10)
fo:0,"You may see the each of the units (Choices B, C, D)" & chr(13) !! chr(10)
fo:0,"or you may review the sections listed above." " chr(13) !! chr(10)
fo:0,"(Menu choice E: Choose a section for review)." " chr(13) !! chr(10)
fo:0,"" " chr(13) !! chr(10)
fo:0,"The section on Definitions (Menu choice F)" & chr(13) !! chr(10)
fo:0,"will provide video or text definitions for" & chr(13) !! chr(10)
fo:0,"any unfamiliar photographic, lens, or film terms." & chr(13) !! chr(10)
fo:0,"" " chr(13) !! chr(10)
fo:0,"You should complete the post-test (Menu choice H)" & chr(13) !! chr(10)
fo:0,"when you have finished the material in the unit. " & chr(13) !! chr(10)
fo:0,"" " chr(12)
t:
:Please remove your recommended viewing plan from the printer.
:press2

T: Do You Know Your Camera?
T: Press any key to continue.
*saver

c: a = a + 1

c: b = b + 1

c (s=1): $S$ = "Y"

c (s=0): $S$ = "N"

c: ans$(l, 24) = n

c: ans$(25, 1) = S$

c: ans$(a+26, 9) = "Choice #"

c: ans$(a+35, 2) = b$

c: ans$(a+38, 1) = stu$

c: ans$(a+39, 2) = ""

c: ans$(a+41, 1) = chr(10)$

c: a = a + 40

e:
This is the post-test for the unit:

INTRODUCTION TO PHOTOGRAPHY

There are 20 questions.

Press any key to continue.

Question # 1

Which shutter speed is not needed on today’s 35mm cameras?

A) A
B) B
C) X

That is correct!

No, that is incorrect.

Watch this video.
A shutter speed of B is used for Black and White film.

T) True
F) False

That is correct!

The correct answer is F.
B stands for a shutter speed of bulb and is not used very often.

The film counter should
A) register 1 when you begin.
B) not register before you take your first picture.
C) register 0 when you begin.

That is correct!

No, that is incorrect.
Watch this video.
2a. The film counter should register 1 when you take your first picture.

T) True
F) False

That is correct!

The correct answer is T.

The film counter SHOULD register 1.

3. You should insert a new roll of film into the
A) right chamber of the camera.
B) central chamber of the camera.
C) left chamber of the camera.

That is correct!

No, that is incorrect.

Watch this video.
Question # 3a

Film is loaded into the central chamber of the camera.

T) True
F) False

That is correct!

The correct answer is F. Film is loaded into the left chamber.

Question # 4

The ASA/ISO index

A) is used to set the light meter to the film speed.
B) describes the size of the final prints.
C) tells how much you should adjust the focal plane.

That is correct!

No, that is incorrect.

Watch this video.
An ASA/ISO index of 400 would be a good film to use indoors.

T) True
F) False

The correct answer is T. ASA 400 is a very light sensitive film.

The film guiderails help to load the film into the camera.

The correct answer is F. Watch this video.
**Question 5a**
The film guiderails help load film into the camera. Keep the film aligned in the camera. The correct answer is B. The film guiderails help to align the film.

**Question 6**
The rewind button is found on the top of most cameras. The correct answer is A. That is correct!

**Question 7**
No, that is incorrect. Watch this video.

152
Question # 6a

The rewind button is found on the bottom of the camera.

T) True
F) False

That is correct!

The correct answer is T. The rewind button IS on the bottom of the camera.

Question # 7

The lens on the 35mm camera will allow you to see what the camera sees.

T) True
F) False

That is correct!

No, that is incorrect. Watch this video.
The lens on the 35mm camera lets you see:

A) an inverted image.
B) what the camera sees.
C) half of the vision field.

That is correct! The correct answer is B. You see exactly what the camera sees.

The sprockets on the film:

A) should fit into the film guiderails.
B) should be engaged on the take-up roller.
C) only attached to the top of the take-up roller.

That is correct! No, that is incorrect. Watch this video.
The sprockets on the film fit into the guiderails.

T) True
F) False

That is correct!

The correct answer is F. The sprockets of the film are attached to the take-up roller.

The lens of the 35mm camera

A) is permanently attached to the body of the camera.
B) can be removed and exchanged with other lenses.
C) should be removed only for cleaning.

That is correct!

No, that is incorrect.
Watch this video.
The lens of the 35mm camera should never be removed.

T) True
F) False

That is correct!

The correct answer is F. You can exchange lenses on 35mm cameras.

You should not adjust the shutter speed on your camera.

T) True
F) False

That is correct!

No, that is incorrect.

Watch this video.
The shutter speed on your camera
A) should not be changed.
B) should be changed at the beginning of each roll.
C) will change depending upon various factors.

That is correct!
The correct answer is C. The shutter speed can be changed depending upon conditions.

You should change the aperture setting to adjust the amount of light which enters the camera.
T) True
F) False

That is correct!

No, that is incorrect.
Watch this video.
Question # 11a

The aperture setting
A) determines the camera focus.
B) determines the final print size.
C) adjusts the amount of light which enters the camera.

That is correct!
The correct answer is C. Aperture setting adjusts the amount of light which enters the camera.

Question # 12

By changing the focus indicator, you can bring objects in the background into focus, while blurring those in the foreground.

True
False

That is correct!

No, that is incorrect.
Watch this video.
Question # 12a

The focus indicator

A) allows you to adjust the focus of the objects in your picture.

B) tells what objects are poorly lit.

C) measures distance from your camera.

That is correct!
The correct answer is A. Use the focus indicator to adjust focus.

Question # 13

The plane of critical focus tells

A) the position at which the lens image is sharpest.

B) which items in the background will not be seen.

C) the distance from your camera to the most distant object.

That is correct!

No, that is incorrect.

Watch this video.
160

The plane of critical focus tells the position at which an image formed by the lens is sharpest. 

T) True
F) False

That is correct!

The correct answer is T. Figures which are in the plane of critical focus are the sharpest.

The aperture control is indicated by the f-stop number.

That is correct!

No, that is incorrect.

Watch this video.
161

You use the camera's aperture control to change the f-stop.

T) True
F) False

That is correct!

The correct answer is T. The f-stop is adjusted by the aperture control.

#ques15

The aperture size

A) controls the shutter speed.
B) measures light falling on the subject.
C) affects how much of the image will be in focus.

That is correct!

No, that is incorrect.

Watch this video.
The aperture control is used to change the shutter speed. 

T) True  
F) False 

That is correct!

The correct answer is F. The aperture control affects the image focus.

An ASA index number of 400 would be a film to use indoors. 

T) True  
F) False 

That is correct!

The correct answer is T. The ASA index number of 400 is suitable for indoor photography.

No, that is incorrect. 

Watch this video.

That is incorrect. 

Watch this video.
The higher the ASA number, the more sensitive the film is to light.

T) True
F) False

That is correct!

The correct answer is T. A film with an ASA of 400 is VERY light sensitive.

That is correct!

That is incorrect. Watch this video.
Question # 17a

The ASA index number is set at 400 for all film.

True

F) False

That is correct!

The correct answer is F.

ASA numbers vary depending upon the film.

Question # 18

The film temperature refers to

A) various types of color and black and white film.

B) the temperature in which you should develop your negatives.

C) the ever changing conditions which exist in photography.

That is correct!

No, that is incorrect.

Watch this video.
Question # 18a

The film temperature refers to what temperature you should use when developing your film.

T) True
F) False

That is correct!

The correct answer is F. Film temperature refers to film type.

Question # 19

The resolution of a film:

A) should not be of concern to a photographer who uses only black and white film.
B) should be changed for each picture.
C) is one factor in determining the final image on a photograph.

That is correct!

No, that is incorrect.

Watch this video.
The resolution of a film helps to determine the final image of a photograph. 

T) True  
F) False

That is correct!

The correct answer is T. Resolution and grain help in determining the final image.

The grain of a film does not affect the final print.

F) False  
T) True

That is correct!

That is incorrect.

Watch this video.
A fine grained film produces a dark photograph. BJ produces a blurry photograph. CJ produces a clear photograph.

That is correct! The correct answer is C. The finer the grain, the clearer the photograph.

Your score was ~f ~- . Your score was

Review The Camera and Film: Shutter Speed
Review The Camera and Film: Film Counter
Review The Camera and Film: Camera Chambers
Review The Camera and Film: ASA/ISO Index
Review The Camera and Film: Guiderails
Review The Camera and Film: Rewind Button
Review What the Camera Sees: Lens Info
Review The Camera and Film: Film Sprockets
Review What the Camera Sees: Changing Lenses
Review Options for My Camera: Shutter Speed
Review Options for My Camera: Changing Lenses
t(p11 = 1): Review Lens: Aperture
f0(p11 = 1):0,"Review Lens: Aperture"!! chr(13) !! chr(10)
c(p11 = 1):p14 = 0
c(p11 = 1):p15 = 0
t(p12 = 1): Review Lens: Focus
f0(p12 = 1):0,"Review Lens: Focus"!! chr(13) !! chr(10)
c(p12 = 1):p13 = 0
t(p13 = 1): Review Lens: Focus
f0(p13 = 1):0,"Review Lens: Focus"!! chr(13) !! chr(10)
t(p14 = 1): Review Lens: Aperture
f0(p14 = 1):0,"Review Lens: Aperture"!! chr(13) !! chr(10)
c(p14 = 1):p15 = 0
t(p15 = 1): Review Lens: Aperture
f0(p15 = 1):0,"Review Lens: Aperture"!! chr(13) !! chr(10)
t(p16 = 1): Review Film Speed
f0(p16 = 1):0,"Review Film Speed"!! chr(13) !! chr(10)
c(p16 = 1):p17 = 0
t(p17 = 1): Review Film Speed
f0(p17 = 1):0,"Review Film Speed"!! chr(13) !! chr(10)
t(p18 = 1): Review Film Temperature
f0(p18 = 1):0,"Review Film Temperature"!! chr(13) !! chr(10)
t(p19 = 1): Review Resolution and Grain
f0(p19 = 1):0,"Review Resolution and Grain"!! chr(13) !! chr(10)
c(p19 = 1):p20 = 0
t(p20 = 1): Review Resolution and Grain
f0(p20 = 1):0,"Review Resolution and Grain"!! chr(13) !! chr(10)
f0(19):0,""!! chr(12)

u: press2
1: 9teen, menu
*Saver

c: a = a + 1
c: b = b + 1
c: s = 1 : ss = "Y"
c: s = 0 : ss = "N"
c: ans$$(1,24) = nls
c: ans$$(23,1) = ss
c: ans$$(a=26,9) = "Choice # 
"c: ans$$(a=35,2) = b
c: ans$$(a=38,1) = stu$S
c: ans$$(a=39,2) = ""
c: ans$$(a=41,1) = chr(10)
c: a = a + .40

e:
*press
  ts: g2, 18
  th: Press the letter of your answer:
  as: stu$
  u: saver
  e:

*press2
  ts: g2, 24
  th: Press any key to continue.
  as:
  e:

*top
  ts: f7
  t: Do You Know Your Camera?
  ts: f3
  t: ****************************
  ts: f7
  t:
  e:

*play
c: vpc$ (9, 80) = "wait; find" !! begf !! "; wait; pLyb" !! endf !! "; wait" !! chr(13)
v: vpc$
e:
APPENDIX D:

ACCESS TO VOICE COMMUNICATIONS ADAPTER PROGRAM
program talk (input,output);

{SU-,R-}

**type**

buffer_type = packed array [1..8] of integer;

Result = record

AX,BX,CX,DX,BP,SI,DI,DS,ES,Flags : integer;

end;

string253 = string[253];

var

sentence : string253;

procedure hello;

begin

writeln('Hello')

end;

var

regs : result;

buffer : buffer_type;

baseid,

cid1,
cid2,
cid3,
cid4,

RCB,return : integer;

procedure initsay;

begin (* initsay *)

regs.ax := $11 * 256 - $11;

regs.dx := $21F;

regs.es := seg(buffer);

regs.bx := ofs(buffer);

intr($14,regs); (* call the open routine for the speech board *)

baseid := buffer[3];

RCB := buffer[2];

clid := buffer[4];

clid2 := buffer[5];

clid3 := buffer[6];

clid4 := buffer[7];

regs.ax := $11 * 256 - $1A;

regs.dx := baseid;

regs.es := seg(buffer);

regs.bx := ofs(buffer);

buffer[1] := 0;

buffer[3] := 1536 + 8192 + 2;
buffer[4] := 0;
intr($14,regs);
buffer[3] := 2;
regs.ax := $11 * 256 + $21;
regs.dx := baseid;
regs.es := seg(buffer);
regs.bx := ofs(buffer);
intr($14,regs);
regs.ax := $11 * 256 + $1F;
regs.dx := baseid;
regs.es := seg(buffer);
regs.bx := ofs(buffer);
buffer[2] := cid2;
buffer[3] := 2;
buffer[4] := 10;
intr($14,regs);
regs.ax := $11 * 256 + $17;
regs.dx := baseid;
regs.es := seg(buffer);
regs.bx := ofs(buffer);
buffer[3] := 0;
intr($14,regs);
regs.ax := $11 * 256 - $16;
regs.dx := baseid;
regs.es := seg(buffer);
regs.bx := ofs(buffer);
buffer[3] := 0;
buffer[4] := 1;
buffer[5] := ofs(hello);
intr($14,regs);
regs.ax := $11 * 256 - $13;
regs.dx := cid2;
regs.es := seg(buffer);
regs.bx := ofs(buffer);
buffer[2] := cid2;
intr($14,regs);
procedure say(sentence: string253);

begin (* call *)

(* first attempt to speak *)

reg.s.ax := $l1 * 256 + $19;
reg.s.dx := cid2;
reg.s.es := seg(buffer);
reg.s.bx := ofs(buffer);
buffer[2] := cid2;
intr($14, regs);

end; (* call *)

procedure deinitsay;

begin (* deinitsay *)

reg.s.ax := $l1 * 256 + $1e;
reg.s.dx := baseid;
reg.s.es := seg(buffer);
reg.s.bx := ofs(buffer);
intr($14, regs);

end; (* deinitsay *)

var
infile: text;
filename: string[20];
x: integer;
begin (* talk *)

initsay:

say('r{160r r{99p This is an introductory lesson on photography.}r}

say('The photography information will be pre "sented on the screen."');
say('You may review information that you wish to see again.');
say('Or you can skip the information and take the post test.');
say('If this is the first time you have used this.');
say('interactive video instruction, you should take the pre test first.');
say('This will be choice ay on the menu.');
say('which will appear at the end of this introduction.');
say('Please follow the directions which appear on the screen.');
say(' and on the computer print out which you will receive.');
say('And now, please press "any "key to continue."');

delay(1800);
deinitsay

da. (* talk *)
The vita has been removed from the scanned document