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DEVELOPING A MIDDLE SCHOOL UNIT ON
COMPUTER LITERACY

A Project
Presented to the
Faculty of
California State University,
San Bernardino

In Partial Fulfillment
of the Requirements for the Degree
Master of Arts
in
Education: Educational Technology

by
Thomas Michael Oliverius
June 1995

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6-16-95
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Abstract

DEVELOPING A MIDDLE SCHOOL UNIT ON COMPUTER LITERACY

Thomas Michael Oliverius

This project is designed to instruct students in the proper method of saving computer documents on a hard drive or floppy disk. Using a self-paced computer-based instructional module, instruction is presented in a simulation that allows the students to practice the actions necessary to complete the operation. The project is based on a nine-stage lesson design that allows the instructor to focus on the abilities and needs of the learners. The findings from this project indicate that the design plan is sound, and that a majority of the students tested months later were able to successfully complete the operation.

Acknowledgements

First, and foremost, I would like to express my gratitude to Kelly, my wife, for her patience and compassion. She was always willing to forfeit her time in order to allow me the time to complete this project.

I would also like thank the faculty of the Educational Technology Program at California State University, San Bernardino; especially Dr. Rowena Santiago, Mr. Sylvester Robertson, and Mr. Brian Arnold. Their guidance in the preparation and completion of this project allowed me to focus on the significant issues and theories confronted in the design of effective educational technology instruction.

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DEVELOPING A MIDDLE SCHOOL UNIT ON COMPUTER LITERACY

Introduction

New technologies provide extraordinary powers to those who master them. Computer systems are still a technology which are in a continuous process of refinement. The designers of these systems are providing the users with overwhelming capabilities which can sometimes lead to confusion or frustration on the part of the user. Like early photography equipment or automobiles, computers are available to those who are willing to devote the effort to master the operations necessary to successfully operate and use these tools. In the educational setting of a program in computer literacy, it is necessary to focus on three explicit goals for the program to become viable.

The first goal is to ascertain the necessary usefulness or relevance of the tasks and sub-tasks that must be carried out to successfully complete a command within a computer operating system. The frequently-used commands are easy to master, but the occasionally-used commands are more difficult to master. Many computer commands involve multiple steps. If a step in a command is not practiced often, the learner may not perceive it as fundamentally relevant or significant. In order for students to achieve this goal, they must be aware that there is a common meaningful reason for completing the command properly.

The second goal is for the students to achieve a level of confidence in consistently carrying out a task successfully. Keller (1983) proposed that confidence pertains to an individual's conviction that if they attempt to complete a task, they will be successful. It is also necessary for the students to realize that they maintain a certain level of control over the outcome of a performed task. In order for a student to achieve this goal, they must be able to reach a certain level of competence before completing the task.

The third goal is to ensure that the task is carried out in a standardized method within the realm of the desired outcome. Minor differences in the procedures used to complete a task can sometimes lead to detrimental and uncertain results. To achieve this goal, it is useful to identify the minimum skills and sub-skills necessary to complete a given task. This will insure that the students can utilize their prior knowledge and apply it to the

situation at hand. Defining a minimal number of skills and sub-skills and setting out definite procedures will also serve to decrease the learning time required.

Problem

In the setting of a middle school computing literacy and applications course using the Apple Macintosh System 7 operating system, it is important that the students learn to store their files on a floppy disk correctly. Stored files can be taken to their other classes, or to the higher grade levels. If their files are not saved on floppy disk, other students may access the files in the hard drive, the default location for saving files. This could result in the other students modifying or deleting the original files. Proper completion of the "*Save as...*" command would reinforce the importance of this operation. The students need not learn the wrong way, i.e., through trial-and-error or frustration, that they are responsible for completing the operation properly.

It is evident that the students are not mastering the "*Save as...*" command, one of the more seldom-used commands. Instead, the students carry out this command without attention to where the file is stored on the computer's hard disk. It is desirable to designate certain specific locations for the storage of documents on the computer's hard disk to simplify finding those documents at a later time. In the case of the Macintosh operating system, the metaphor of a file cabinet and file folders within the file cabinet create a method that facilitates the organization of documents in the computer.

It is observed that the less often the "*Save as...*" operation is carried out, the less successful a student is in completing that command properly. In order for a student to achieve a level of competency that results in success, it is necessary to design instruction that is based, as much as possible, on the students' prior knowledge and skills. In order to reinforce the use of these prior skills, and to introduce new learning, it is necessary to carefully guide the students through the steps necessary to complete the operation properly.

The students need to be confident that the steps they follow will lead to the proper completion of the desired command. The students can then expect to be successful when performing similar operations on the computer. In carrying out these operations in a consistent manner, the desired outcome of an operation can be achieved.

Purpose

The purpose of this project is to design a self-instructional module that will train the students to properly execute an Apple System 7 operating system command. This project will emphasize on meeting the three goals stated above. These goals will be applied to one of the less frequently-used commands, the "*Save as...*" command, in this Apple operating system. It will include a review of the literature related to the problem, including the issues and factors dealing with the problem, procedures utilized to achieve the objective of this project, and the findings from field testing a portion of the material with middle school students.

Review of the Related Literature

Since this project focuses on the execution of a command that is offered as part of the Macintosh operating system, it is meaningful to investigate the general definition of an operating system. A computer operating system is the program that organizes the internal activities of a computer and its peripheral devices. An operating system performs basic tasks, such as moving data to and from devices, and managing information in memory. A computer operating system is often referred to as system software. Word processor programs, spreadsheet programs, and other programs that perform a very specific task are called application programs. The operating system provides the link between the application software and the hardware of the computer. An operating system permits the user to run programs or applications, and to control the transfer of information between a peripheral and the computer's memory. The operating system also allows the saving and naming of documents on a hard disk drive or floppy disk, and can be used to remove, or delete documents. It can provide a listing of the saved documents, and can copy the documents from the disk to another device (Coburn, Kelman, Roberts, Snyder, Watt & Weiner, 1985).

A computer operating system manages the computer's operations. It transmits information to and from disks, printers, and other devices. It establishes and keeps track of files, and directs processing inside the computer. Most operating system activity is invisible to the user, hence the difficulties in conceptualization of the operations involved.

Application programs, or the software used for word processing and other specialized work, rest on the foundation provided by the operating system (Apple Computer Incorporated, 1994).

Relevance

The first goal introduced is to establish the relevance, or usefulness, of a computer operation. This is achieved by understanding that the methods used in any area of instruction must produce meaningful knowledge (Keller, 1983). The instruction must fulfill the needs of the learners' in the best way possible. Since tasks that are frequently used are usually easier to master, and those that are used only occasionally used are more problematic, there must be purposeful opportunities for the learners to use an acquired skill, and it's associated sub-skills. It must also provide the learners with choices, control, and capabilities. Finally, the instruction must be linked, as much as possible, to the prior experiences of the learner (Gagné, Briggs & Wagner 1992).

This goal of relevance can be realized when the learners sense that, in the process of instruction, they are building upon and improving their understanding of previously acquired computer concepts. The learners are increasing their vocabulary of useful computer terms, and they are able to make a more informed decision regarding which operating system is more appropriate to a given situation. Many computer operating systems are alike at their most basic levels. Then, when the learners are put in a position that requires them to learn a different operating system, they will have a deeper understanding of the structure of operating systems in general (Pratt, 1984).

In order to build relevance, it is necessary for the students to be aware of a mutually useful reason for completing a computer command properly. With the students' first experience of the frustration of a lost or deleted document, their awareness of the reason for properly saving their documents is reinforced.

This process of knowledge transference also leads to enhanced critical thinking skills. They will perform operations on the computer, possibly combining the knowledge of one operation with another, and transfer that new knowledge to a third skill. They will be better able to conceptualize the overall operations of a computer (Carin & Sund, 1989).

Confidence

The second goal presented in the introduction is that the students must be confident that they can properly and consistently complete a computer command. In the course of developing instruction leading to the attainment of a computer skill, it is important to realize that what the students see and hear on the computer is removed from what actually is occurring in the computer. It is difficult for students to perceive that the movements of a computer mouse are being translated into electrical signals inside the computer. It is also difficult for students to internalize the concept that when a document is stored in a computer's hard disk drive, it has no physical form or shape. The concept is an abstract idea which is only represented on the screen as a picture or icon. In an attempt to make these ideas more meaningful to the students, it is imperative to utilize methods that will transport the students' thinking from concrete to the abstract.

Through the use of the real objects that are represented on the computer screen it is possible to present some intangible concepts to students. A file box can become the hard disk drive, a pad of paper can represent a document, a cardboard arrow becomes the screen pointer, and a trash can would mimic the computer's on-screen trash can for deleting documents. Having the students perform some basic operations with these objects can serve as a useful basis for further instruction. In moving the students' thinking from the concrete level to the more abstract level of the actual computer in performing the same operations, we enable the students to realize success at more than one level of understanding. This suggests that it is necessary for the learner to use critical thinking skills when approaching a new concept. It is also suggested that a student who believes that their personal actions determine their interaction with computers, the student has an internal locus of control. Those with an external locus conclude that outside determinants control the actions and effects of computers. Of these two groups, it is presumed that the individuals who have an internal locus of control will attempt to learn more about computers because they conclude that their ventures will lead to success (Kay, 1990).

Critical thinking skills include whether or not the student can apply learned skills to use the computer as a tool to enhance their education. The students with an internal locus of

control usually perceive that they can work with a computer on a more independent basis, and that they are confident that they can use computers effectively. These students also realize that they become their own problem solvers, and are usually the students who discover new concepts with little or no instruction (Kay, 1990).

Standardization

The third goal presented in the introduction, the standardization of skills focusing on a desired outcome, is applied to computer operating systems by Alfred Bork (1985). Bork indicated that a common view is that when a number of computers can utilize the same operating system, the transfer of knowledge from one system to another is carried out with less effort. When the first small computer operating systems were designed little attention was given to the idea that there could be a standard operating system for all computers. Presently, two major operating systems are in widespread use in the educational community.

The Microsoft Disk Operating System (MS-DOS) was developed in the early 1980's for use on International Business Machine (IBM) computers and other compatible computers. The MS-DOS operating system operates from commands typed at a keyboard. The commands are numerous, and many commands can be modified to extend or restrict their basic operation.

In 1984, Apple Computer Corporation developed the Macintosh computer, and designed an operating system for it. The Macintosh operating system features the use of icons, or graphic representations, to depict items stored in the computer. The user moves a pointing device, or mouse, on a flat surface. Those movements are translated into the movements of a pointer on the computer screen. The user can execute computer commands by pointing to an object on the screen, and clicking a button on the pointing device (Lockard, Abrams, Many, 1993).

There is an effort to standardize on a single operating system for computers. Microsoft Corporation has developed the Windows operating system for IBM compatible computers which uses a mouse in a manner closely resembling Apple's system. Many of the commands in the Windows system mimic the commands in Apple's system, down to the look of the various icons and presentation screens. Even more recently, both IBM and

Apple have agreed to develop similar computers based on the new Power PC technology (Corcoran, 1993). Whether or not these two corporations agree on a single standardized operating system is an issue that will more fully develop in the future.

Project Design

The design of this project addresses the problem of students not saving their word processed documents properly on their floppy disks. Students instead save their documents on the system hard drive, which results in other students accidentally or intentionally deleting their documents. Furthermore, students must save their documents so they can take them to the next grade, or school they will attend, where they will be used for assessment purposes by instructors. Front-end analysis of the problem showed that instruction on the use of the "*Save as...*" command properly will help solve the student's lack of knowledge regarding saving documents on floppy disks. Based on observations, it was also discovered that most students have not mastered the concepts of file management and organization, and the specific procedures for saving files to a floppy disk.

Project Goal

The goal of this project is to develop a concise unit of instruction which will address the lack of skills necessary to carry out the "*Save as...*" operation in the Apple Macintosh System 7 computer operating system.

Instructional Design

There are several models of instructional design which are suitable for the design of this course unit. One widely accepted model is the Dick and Carey model which categorizes all of the stages in any instructional model into three discrete functions: (1) identification of instructional outcomes, (2) development of instruction, and (3) the evaluation of the effectiveness of instruction. These functions are expanded into nine stages, or activities, presented by Dick and Carey (1990). Following an explanation of these nine stages, the design of this project will be discussed.

Stage 1 - Instructional Goals

In identifying the outcomes of instruction, it is necessary to achieve a desirable state of affairs or goal. An example of a desirable, and instructional goal is that every adult in the

nation be literate at a sixth-grade reading level. An example of a non-instructional goal might be that every adult have adequate medical care. The latter goal is not obtainable by instruction.

Stage 2 - Instructional Analysis

The purpose of instructional analysis is to determine the skills involved in reaching a goal. It is necessary at this point to investigate what component skills would have to be learned through a learning-task analysis. The learning-task analysis would list the skills used at each step in the procedure, along with the subordinate skills necessary to complete each step (Gagné et al., 1992).

Stage 3 - Entry Behaviors and Learner Characteristics

This step determines which of the required skills indicated in step 2 the learners must bring to the lesson. This also enables the designer to choose the level at which instruction will begin. Realizing that since some learners know more than others, the instruction will be redundant for some, and necessary for others. The designer must also determine the skills of an intended audience by interviewing and testing of the targeted group.

Stage 4 - Performance Objectives

To be able to measure learner performance to determine when objectives have been met, it is necessary to state all objectives in terms of performance. Performance objectives are statements of observable, measurable behaviors. By providing a method to determine whether the goals are related to the instructional methods, a performance objective guides instruction and evaluation.

Stage 5 - Criterion-Referenced Test Items

Before the development of lesson plans and instructional materials, it is advantageous to plan the performance measures that focus on the objectives of the lesson, rather than on what the teacher has done, or the learner has read. This will determine whether the students have acquired the desired skill, and not simply remembered the presentation of the lesson. This performance assessment should be a summative evaluation which determines the success and value of the lesson in its final form.

Stage 6 - Instructional Strategy

The instructional planning is the point at which the lesson designer must associate knowledge of learning and design theory with the experience of the learner and the corresponding objective. Instructional strategy is a plan for assisting the learner with their efforts to achieve each objective and performance level. This could take the form of a lesson plan, or a set of specifications that signal completion of a specific set of objectives.

Stage 7 - Instructional Materials

Instructional materials include printed or other media intended to communicate the events of instruction. The better established objectives will more precisely determine the content of the materials. Four general principles apply to this stage. First, a greater portion of the materials will not be available commercially when innovative objectives are encountered. Second, developing materials is almost always more expensive than selecting available materials. Third, expenses can be minimized by selecting materials that are available and integrating them in a manner that covers all of the desired objectives. Fourth, the teacher's role is affected by the choice of delivery system and the range of materials since the teacher will have to provide the missing events that may be needed by the learners.

Stage 8 - Formative Evaluation

Formative evaluation is designed as a step in which instruction is revised so that it is as effective as possible for the majority of the students. A three level process of formative evaluation is described by Dick and Carey (1990). First, learners representative of the target audience are used as a trial audience on a one-on-one basis with the teacher. Structure and logic problems become evident at this time, and the learners can provide verbal feedback on the process. Second, a small group tryout, in which the materials are given to a group of six to eight students, is used to focus on how the students use the materials and how much assistance is needed. The third step is a field test, in which the revised instruction is presented to a whole class. At this point, it may become evident that the instruction be modified. Changes at this stage will occur because of information derived from any of the previous steps.

Stage 9 - Summative Evaluation

A summative evaluation is normally conducted after the lesson has been through the formative evaluation stage. It is a study of the effectiveness of the system as a whole. This can occur during the first field test, or much later, when large numbers of students have been instructed by the new system. One method used in a summative evaluation is to systematically assess the mastery of the lesson's objective. This will result in a quantitative indication of the accomplishments of the learner. A measurement of the success or failure of a group of learners utilizing the lesson will serve as convincing evidence that the lesson is effective.

Instructional Goal

The purpose of this project is to develop computer based instructional material that will address this instructional goal: The students will save their documents only on their floppy disk.

Instructional Analysis and Performance Objectives

Each step required to complete the objective of saving a document is given certain necessary sub-skills. For each competency, recognition and identification skills are described.

In step one, the student will select the "*Save as...*" command from the file menu. The student will locate and open the file menu. The student must also discriminate among the options found in the file menu (see Appendix B).

In step two, the student will type the name of the document in the "*Save document as...*" box. Here also, the student will locate the "*Save document as...*", and discriminate among the parts of the box. The student will also edit text in a word processing environment (see Appendix C).

At step three, two conditions will exist. Depending on the state of the operating system, the tasks may differ. If the floppy disk icon with the student's name appears in the location box, steps four and five will be skipped, and the student will transition to step six. If the floppy disk icon does not appear in the location box, steps four and five will be completed before step six. The student will locate the location box and discriminate among

the icons pictured in that box (see Appendix D).

At step four the student will click on the desktop button in the "*Save document as...*" box by locating the desktop button. At this point the floppy disk icon will appear in the location box (see Appendix E).

In step five, the student will double click on the floppy disk icon in the location box. Discrimination among the icons presented is necessary at this point (see Appendix F).

In the sixth step the student will click on the save button to complete the operation. Here the student must locate the save button, and discriminate from the other buttons available (see Appendix G).

Step seven is reached when the student successfully completes the lesson. The student has the option of practicing the lesson again (see Appendix H).

Entry Behaviors and Learner Characteristics

The learners are seventh and eighth grade middle school students. These students have received instruction in key boarding and basic word processing skills in the sixth grade. They possess prerequisite skills which include the ability to use a computer mouse for moving, clicking, and selecting objects on the screen, along with recognizing and identifying icons on the screen. In prior computer courses, the students have learned the necessary terminology and vocabulary (see Appendix A). They have not received previous instruction on the Macintosh operating system, concerning the use of floppy disks for storing their documents.

Criterion-Referenced Test Items

The assessment of learner performance in this unit serves to detect the students' misunderstanding of how to properly save their documents. This unit is intended to determine if the students have acquired the desired skill, of performing the "*Save as...*" operation properly. The criteria at this stage is that the students save their documents in the proper location on the hard drive of their computer.

Instructional Strategy

To provide the events of instruction in this lesson, information external to the learner that support the learner's internal schema of learning have been determined. The lesson is

focused on informing the learner of the required objective(s), and stimulus with feedback is provided at appropriate points. The lesson follows the sequence indicated in the steps above (see Appendix I). Successful completion requires that the student complete each step properly. Since the students are using the same computer to complete the lesson as they use to actually save their documents, the tools are familiar to them. The prerequisite skills necessary for each step ensure that all students will be successful.

Each step or screen of the lesson allows the student to choose responses that are exactly like those they will be presented with when using the actual program (see Appendixes B-H). Automatic or contrived responses are not available. If a student does not choose the correct response, the lesson will not move forward.

At the beginning of the lesson, and at each step, the objectives are presented to the students in terms that are previously recognized. At the end of each step, and at the end of the lesson, reinforcement of the objectives are presented.

User interest is maintained by the liberal use of color. The presentation of the same screens they will use when using the actual program also allows the learner to practice their skills in a non-threatening manner. If they do not complete a step correctly, no real consequences result. The actions required of the user are not ambiguous. Each step is presented with ample textual and graphic information so that they cannot perform an incorrect action. Only if a student performs the correct action, does positive feedback occur. This is usually associated with a sound of applause, and movement to the next step. Negative feedback consists of another sound, "Whoops-see daisy!".

Student attention is gained at the beginning of the lesson by presenting the initial operating instructions using a colorful text and background scheme. The lesson proceeds by informing the learner that they will be practicing the skill associated with the objective.

From this point, the lesson proceeds in a linear manner with performance guidelines tied to the objectives for each step. Performance assessment occurs throughout the lesson, since the only way to move to the next step is to complete the current step. Only when a student can demonstrate that they can complete the objective with no instruction will they come to completion. The student cannot complete the lesson unless they complete the steps

correctly, therefore completion signals acquisition of the skill.

With the appropriate use of sounds and special effects the attention span of the learner is increased, and a higher level of interest is maintained. Inquiry is stimulated by presenting questions or problems to be solved. Relevance is reinforced by the use of materials related to the learner's experience, and the use of a presentation tool familiar to the user. Motivation and goal orientation presents the purpose and usefulness of the lesson. Confidence in the learner is generated by making the learner aware of what the evaluation criteria and expectancies are in advance. Feedback that supports the student's success is textual, graphic, or audible. Satisfaction is enhanced as the students are provided with an opportunity to use new knowledge or skills. Feedback that enhances further desired outcomes during the lesson is varied and effective. Consistent standards for all students apply. Successful completion of the lesson determines whether the objective of the lesson has been met.

Screen space is used freely, with attention to utilizing functional areas consistently. At any point in the lesson, the learner can stop the lesson, or restart the lesson from the beginning. Since it is expected that the learner will complete the lesson in less than ten minutes, it is not necessary to break the lesson into smaller parts.

Labels for each screen are presented in the same locations, as are graphics and textual information. Information is displayed so that normal eye movement, left-to-right, top-to-bottom, allows the learner to acquire information in a more natural manner.

Text information is presented within text fields limited to eight words per line, and no scrolling is necessary. No page contains all text, and instructions are presented before a response is required. All text is presented legibly, using as much lowercase text as possible to minimize density. Important terms are highlighted, with no more than three terms highlighted per screen. The font used is consistent throughout the lesson.

Graphics are presented throughout the lesson, with the actual computer menus and buttons simulated on screen. The background for each screen is yellow, with dark blue text in the informational/instructional area, and black text on a white background in the simulated menu areas.

Approximately 20-30 hours was spent in developing this instructional module. Gathering the menus and dialogue boxes as graphics, and programming the actions took up the majority of this time. Testing and evaluation took an additional 10-15 hours.

Instructional Materials and Environment

Instruction is carried out in a regular computing classroom (see Figure 1). There are thirty-two Macintosh LC computer workstations available for student use, and one instructor workstation. Each workstation consists of a Macintosh LC computer, a thirteen inch color display, computer mouse, and keyboard. For demonstration, the instructor can utilize a projection system which enables the entire class to view the instructor's computer screen.

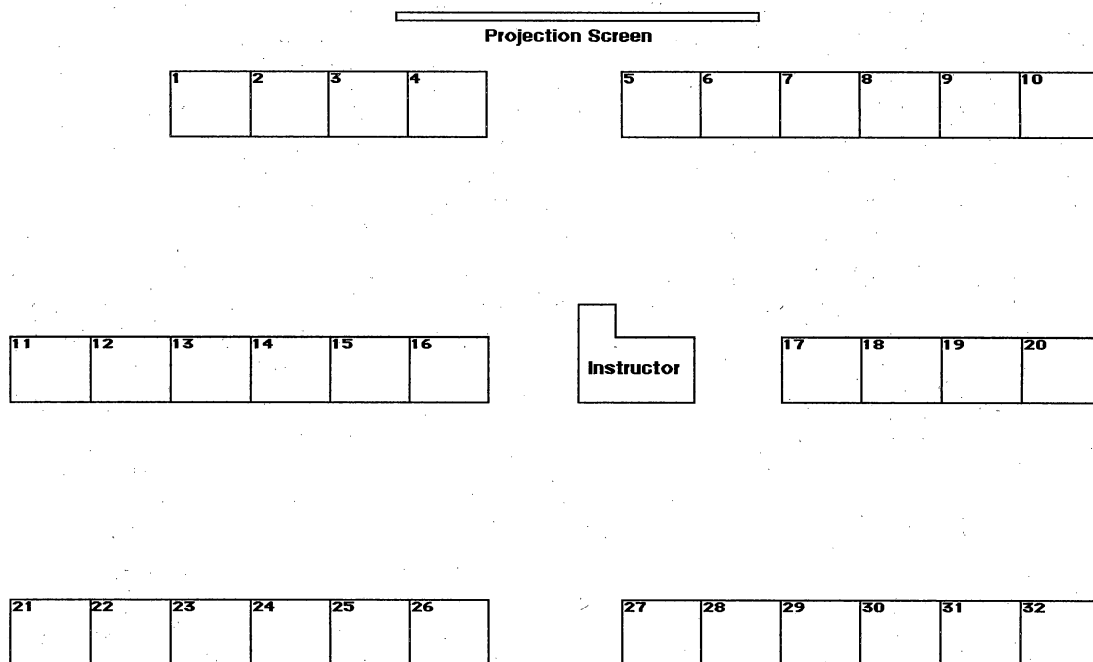


Figure 1. Classroom Diagram

The computer software used is HyperStudio, developed by Roger Wagner Computing, which is utilized here as a presentation system (see included diskette). Since it is possible with HyperStudio to simulate exactly the screens and buttons that the actual operating system software uses, the choice of this program to present the lesson is

appropriate. HyperStudio makes it possible to select any area of a drawing, or text, to use as a button. Text fields also simulate the same text boxes used in the Macintosh operating system. The ability to use color and sound in HyperStudio presentations enhances student attention. The ease of developing a HyperStudio stack, with no programming minimized development time.

Formative Evaluation

The prototype lesson was tested in three environments. First, in a one-to-one situation, with three students. These students were first evaluated to determine whether they could successfully save a document in a specified location on the hard drive. It was often the case that the students would save their document in the default location presented in the "Save as..." dialog box. After practicing with the lesson it was evident that the students were able to complete the lesson without failure after two to three trials.

The second test involved a group of eight students from a seventh grade computer classroom. This evaluation focused on how the students used the presentation, and how much assistance they needed. It was apparent that the students could complete the lesson with minimal assistance. They used the presentation in an appropriate manner, and did not take an excessive amount of time to complete the lesson. Revisions occurred only if it was apparent that either instructions are not clear, or if there appeared to be errors in the sequence of the lesson. These revisions were made either during or immediately after testing with this group.

The third group to test the lesson included 221 students, divided into class groups of 32 to 38 students in each class. This field trial included revisions that were made on the basis of the one-on-one and the small group trials of eight students. This large group made it possible to make the lesson as effective as possible for the largest number of students. It was discovered that at this point, the lesson was valid and reliable for this audience.

Summative Evaluation

The summative evaluation was designed to assess the proficiency of the learners and their ability to master the lesson's objective. In this case, the evaluation involved twenty-eight students enrolled in a computer literacy and applications program. The students were

assessed at three stages of the course.

The students were first evaluated immediately after a single oral and visual presentation by an instructor, regarding the proper method of saving a computer document. The presentation was presented to the students in a large group situation. At this stage, the students had not received individual instruction. The students were allowed to perform the operation, and it was found that five percent of the students were able to consistently perform the "*Save as...*" command correctly.

The second stage of evaluation occurred after the students had practiced using the "*Save as...*" command utilizing the HyperStudio demonstration. They were then again permitted to use the command on their computers. After a period of three weeks, the students were assessed, and 94 percent of the students correctly and consistently completed the command.

The third evaluation took place seven weeks after the students computer literacy course had ended. The only exposure the students had to computers was in their academic course classrooms, approximately one hour per week. There was no formal computer literacy instruction during this seven week period. The students were evaluated individually, and observations were recorded that indicated the students' ability to fulfill the objective of this lesson. If the students saved a document in the proper location, it was evident that they were successful. The results indicated that 87 percent of the group had retained the ability to correctly perform the command.

From the results, it is evident that the method utilized to present a concept that is difficult for the students to master is valid, reliable, and assists the learner by providing an alternative, non threatening way to practice a skill. The students were able to perform the "*Save as...*" operation as many times as necessary to become consistently successful. By using a simulated computer screen, the students could commit errors, and not damage the documents previously stored on the hard drive. It was also clear that the students were more motivated to use the lesson. The use of sound and colorful displays kept student interest at a high level which increased the retention of the lesson's objective.

Appendix A
Glossary

application program - a program written for some specific purpose, such as word processing, database management, graphics, or telecommunication.

button - A pushbutton-like image in dialog boxes and other locations that one clicks to designate, confirm, or cancel an action.

choose - To pick a command by dragging through a menu. One normally chooses a command after selecting an object for the command to act on.

click - To position the pointer on something, and then press and quickly release the mouse button. Clicking is normally used to select an icon, a word or object in a document, or a choice in a window, or to confirm a choice in a dialog box.

command - An instruction that causes the computer to perform some action. The most common form of commands are listed in a menu.

data disk - A disk that normally contains letters, budgets, pictures, and so on - in the form of documents.

default - A value, action, or setting that a computer system or application program automatically assumes, unless it is changed by the user.

desktop - The working environment on the computer - the menu bar and the background area on the screen. There can be a number of documents open on the desktop at the same time.

destination - The disk or folder that receives a copied or translated file, as in "destination disk."

dialog box - A box that appears on the screen to present a message or to request more information from the user.

directory dialog box - A type of dialog box used to locate files and change disks from within an application program. Directory dialog boxes appear whenever the Open or Save as... commands are chosen from within an application program.

disk - A flat, circular, magnetic surface on which information can be recorded in small magnetized spots, much as sound is recorded on tape.

document - Any file created with an application. Documents are usually represented by icons derived from the icons of the programs that created them.

file - any named, ordered collection of information stored on a disk.

Application programs and documents are examples of files. A file is made when one creates text or graphics, the material is given a name, and it is saved on a disk.

File menu - A menu that lists commands that affect whole documents - commands such as Save, Save as..., Print, and Quit.

Finder - A part of the Apple Macintosh system software that created the desktop environment. The Finder is always available. The Finder is used to manage documents and application programs, and to get information to and from disks.

floppy disk - A disk made of flexible plastic that stores computer data.

hard disk - A disk made of metal, and permanently sealed into a drive or cartridge. A hard disk stores very large amounts of information and operates much faster than a floppy disk.

icon - an image that represents an object, a concept, or a message.

interface - The method a computer uses to communicate with the user. Often referred to as the computer's human interface, or user interface.

menu - A list of actions from which the user can choose a command. Menus commonly appear when the user points to and presses the mouse button on the menu titles in the menu bar or in a dialog box.

menu bar - The strip across the top of the computer screen that contains the titles of the menus available in the active application.

mouse - A small device that controls a pointer on the computer screen. When the mouse is moved on a flat surface, the pointer moves to reflect the same action on the screen.

mouse button - the mechanical button on the top of the mouse. In general, pressing the mouse button initiates some action on whatever is under the pointer on the screen, and releasing the button confirms the action.

pointer - An arrow or other symbol on the screen that moves as you move the mouse. The pointer is used to select items, choose commands, move data, and draw in graphics programs.

program - A set of instructions describing actions that a computer performs to accomplish a task, conforming to the rules and conventions of a particular programming language. Computer programs are collectively referred to as software.

save - To store information by transferring it from main memory (RAM) to a disk. Work not saved disappears when the computer is turned off, or when the power is interrupted.

scroll - To move a document or directory in it's window so that a different part of it is visible. To scroll through a document or directory, the scroll arrow, scroll bar, or scroll box is used.

select - To designate where the next action will take place. To select an object with a mouse, click on that object's icon.

system software - Programs that manage the operation of a computer in order to allow application programs to run. Also known as the operating system.

Appendix B
Card One
Introduction and Instructions

Saving Macintosh Documents

In this lesson, you will learn how to save a computer document on your floppy disk, and not on your hard drive where someone else MIGHT delete it!

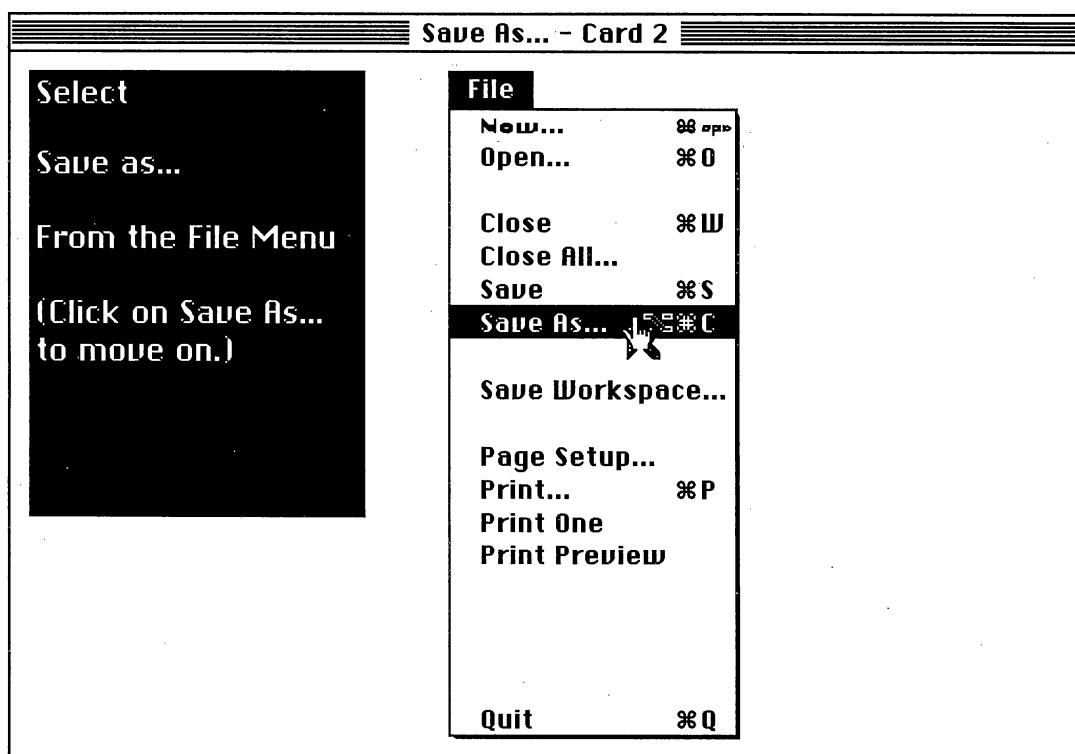
Follow the directions on each screen to complete the lesson.

Click Here to Begin

Appendix C

Card Two

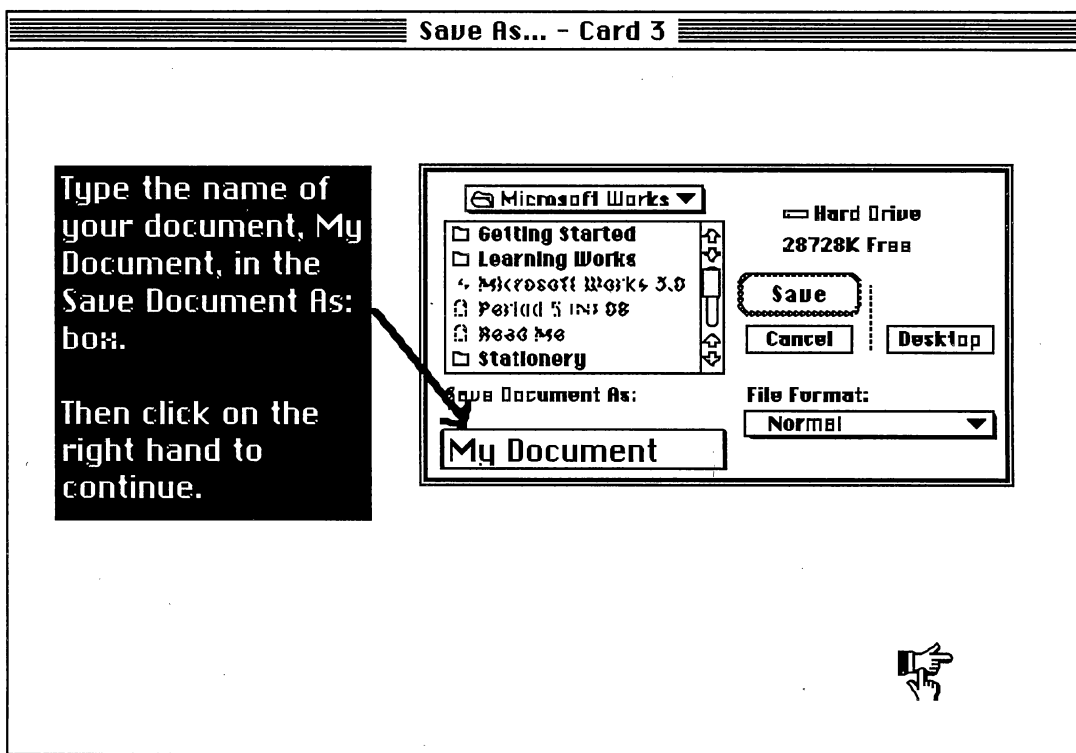
Step One



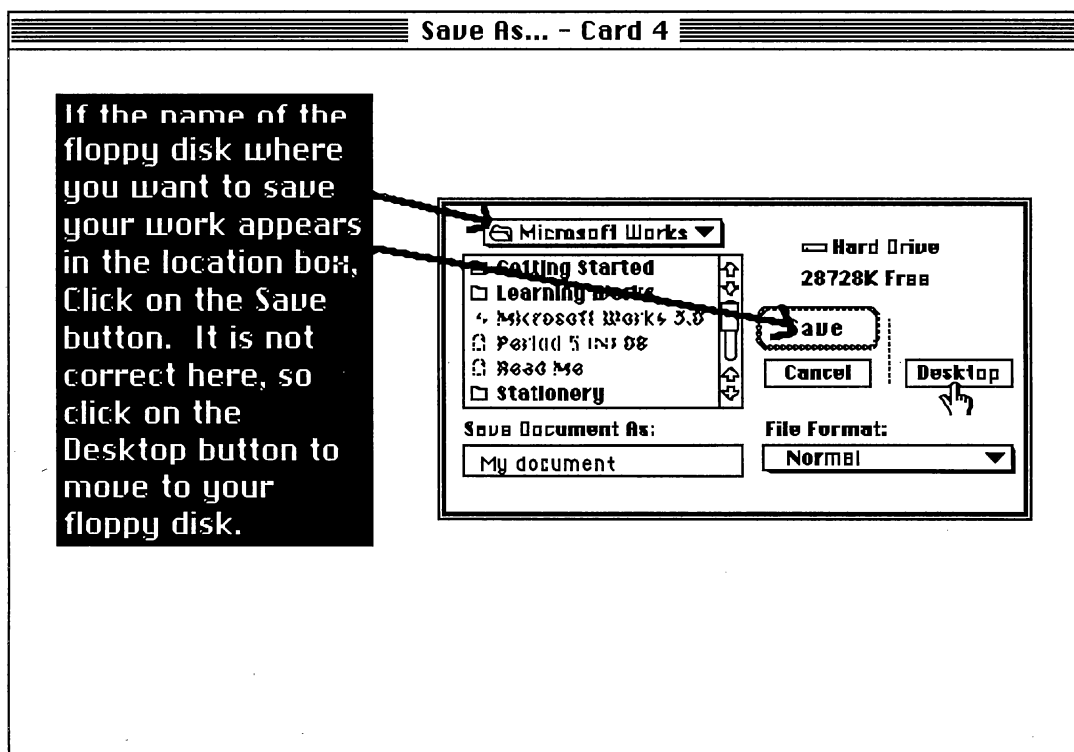
Appendix D

Card Three

Step Two



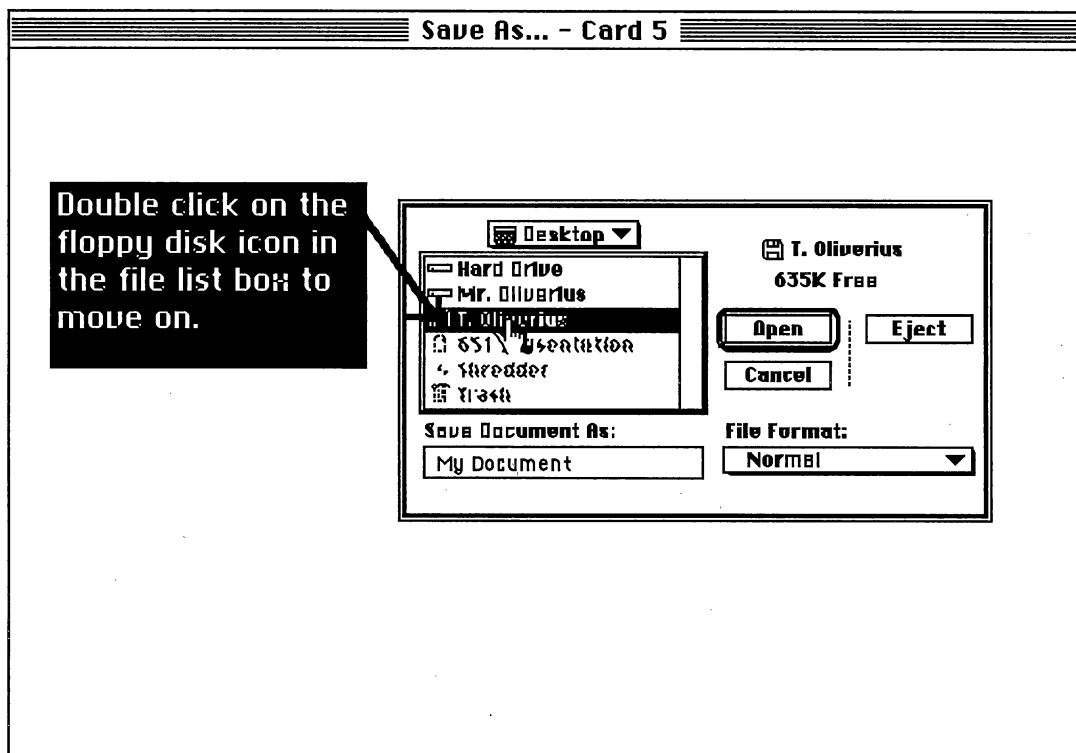
Appendix E
Card Four
Step Three



Appendix F

Card Five

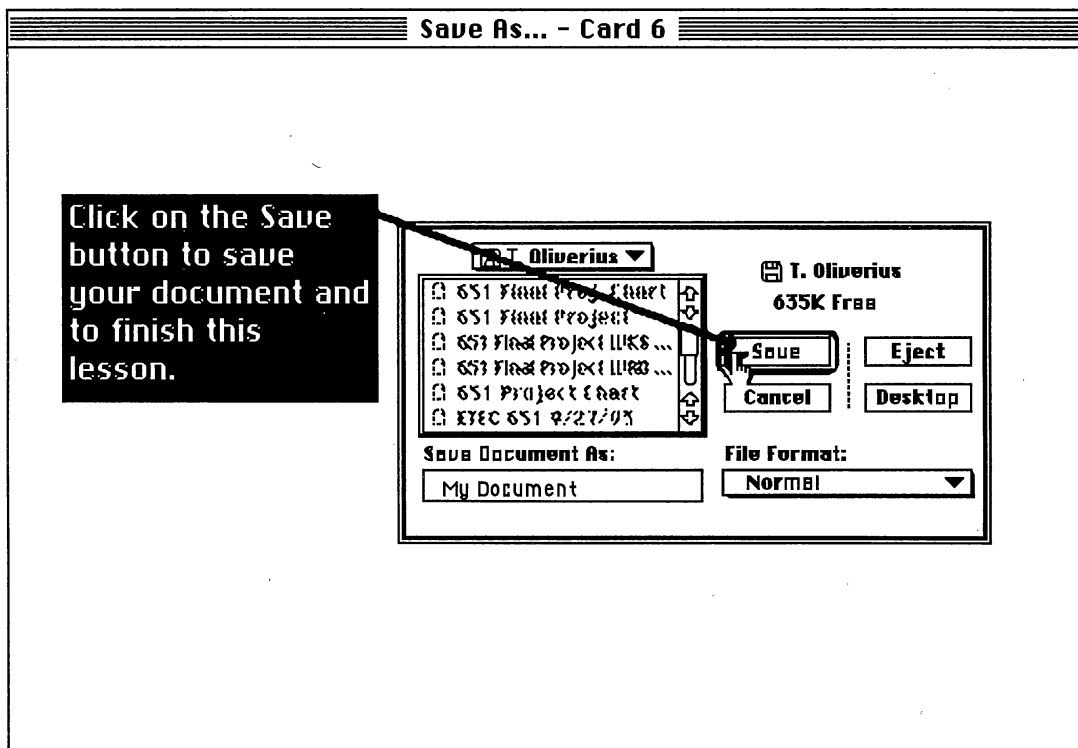
Step Four



Appendix G

Card Six

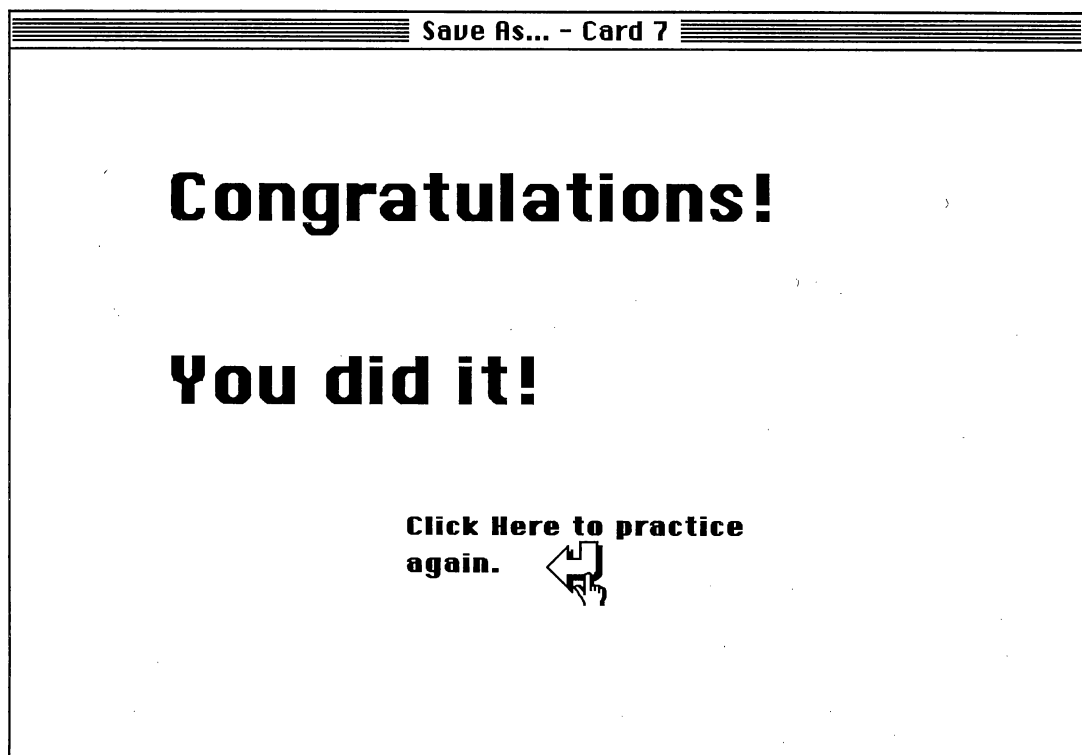
Step Five



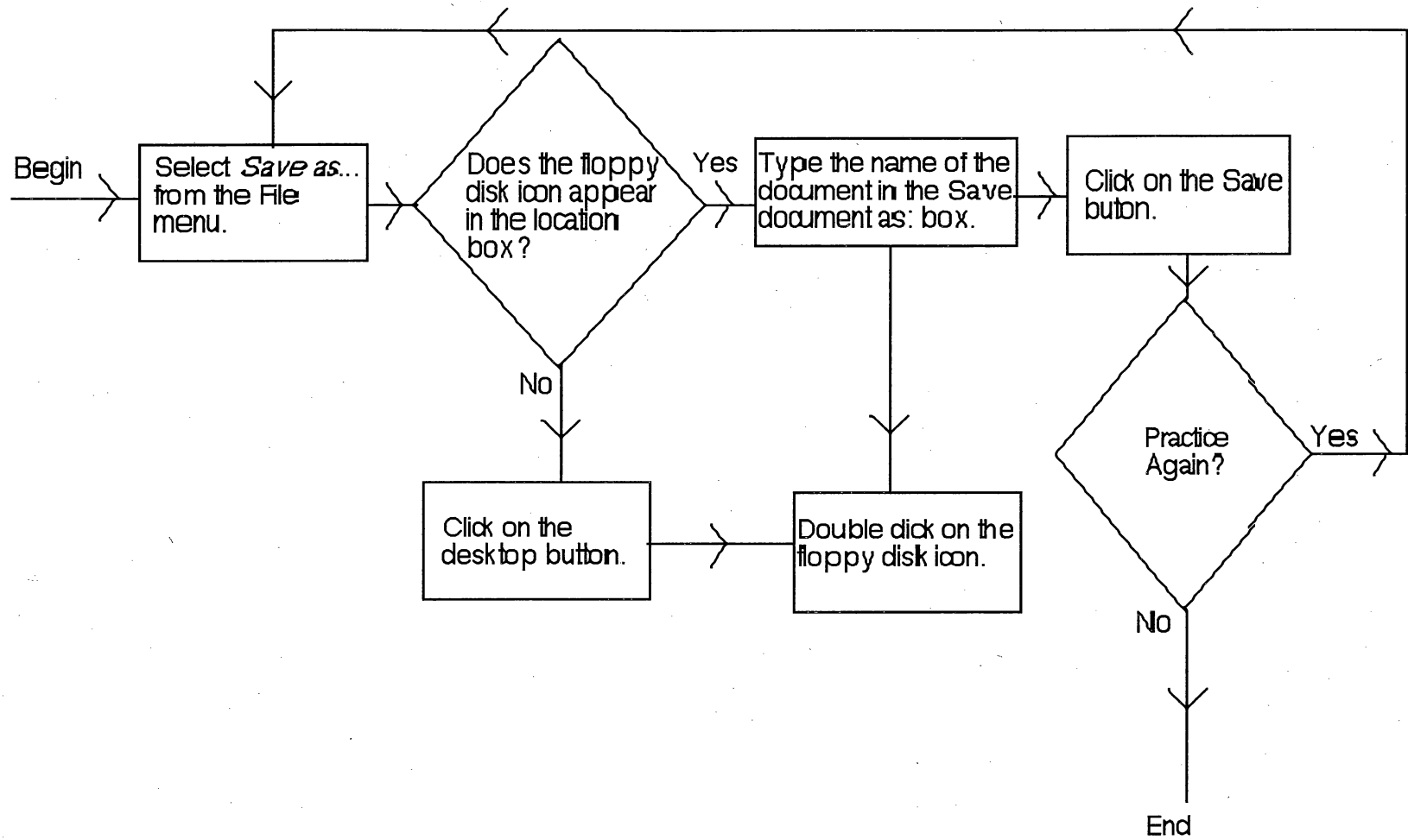
Appendix H

Card Seven

Step Six



Appendix I
Lesson Flowchart



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