A Demonstration of Computer Assisted Instruction Using Authorware Professional to Teach Basic Theology

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Thesis Project Discussion: A Demonstration of Computer Assisted Instruction Using Authorware Professional to Teach Basic Theology

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Table of Contents

Thesis Discussion
Stan Brown

1.0   Introduction

The purpose of this thesis is to investigate principles which are basic to Computer Assisted Instruction and how Authorware Professional is able to make use of these principles.

A computer assisted instruction module will be produced to demonstrate these principles within the Authorware environment. This module would be used by an individual end user. This module provides enough specific instructions within the program itself that an end user may easily use it. There are two major reasons for choosing Authorware. The first is that I have had experience using this product in different ways. These include public presentations for the library and a simulation module for a graduate class. The second reason is that in light of that experience I believe it provides an excellent vehicle for computer assisted instruction. Authorware Professional may be described as having some relationship to Director but is easier for the end user and thus allows for more emphasis on methodology rather than learning the details of the software.

The particular vehicle which was chosen is instruction in basic theology. The reason for choosing this vehicle is that I have a Master's of Theology degree and twelve years of experience as a minister. This enabled me to concentrate on the methodology used in the module rather than the content as I could be my own resource. My experience in communication and teaching also provides a valuable background for this thesis. Many of the means of communicating ideas used in this module draw upon my experience in dealing with people and communicating concepts to them.

This description is designed to convey the major concepts I learned while producing this module as well as provide a basic description of the program itself. As such, it includes a description of basic general principles, a general description of Authorware, the way Authorware was used in the program, a discussion of my response to user suggestions and some thoughts for future study. The major part of the project is the program itself. This document seeks to clarify methods, structure and learning.

1

2.0 Preparation for Module

The following ideas were used in the preparation of the module. Items one and two in the **annotated bibliography** were of most help in the following concepts. Also, as mentioned in the introduction, personal experience was of great help.

1. **Instructional objectives** must be considered. The objectives in this program are to provide a basic understanding of theology along with creating an interest in further learning. The manner in which this was carried out is teaching basic theology in a simple manner while providing enough suggestions which would open the user up to deeper questions which are not covered in this program.

2. **Prospective Users** must also be considered. This program is intended for those who desire instruction in basic theology. It can also be used to gather ideas for instruction in basic theology. It should lead to asking questions and further research. It is not intended to answer all questions concerning theological concepts.

3. A general **story board** needed to be produced in order to plan the flow of the program. In this case the story board needs to be done for planning purposes but must also be flexible enough to allow for certain changes as the actual module is produced. The greatest amount of flexibility in the production of this program occurred in the modules which are at the greatest level of detail. The general format is followed without much change to allow for consistency in the user interface.

Authorware provides an excellent vehicle for using this technique since it is a visual storyboard itself. After my initial designs on paper, I used it to keep a consistent design throughout the program. This was accomplished by copying one section into another and modifying it. An example of this is that after finishing the section on Bibliology, I copied it and then pasted it as the section on Theology Proper and proceeded to modify each subsection. This saved a great deal of time in both design and production of the module.

4. The **general design** which relates to the story board discussion above included the following elements.

a. A consideration of **instructional objectives** which are discussed in number one above. The two basic ideas 1) keep it simple and 2) create an interest in further learning for the future are demonstrated throughout the project. One good example of this is found in the II-B-2 section. The discussion is kept to simple answers regarding the questions of man's responsibility in relationship to God's revelation. In addition there are suggestions which open up almost limitless thinking concerning related ideas such as God's fairness. This demonstrates additional possibilities for the program. First, it can be used by individuals in order to prepare for a discussion. Secondly, it can be used as a visual aid in a classroom setting. Thirdly, the possibility of additional programs on deeper areas of theology is broached.

b. A consistency in **branching options** needs to be maintained for ease of use. This program is designed to be used with a minimum of outside help. This is maintained consistently throughout the program. The branching options are the same throughout the entire program.

2

c. **Screen design** is an important aspect of the interface. This is an area where end user input is particularly valuable. There are at least two areas of interest here. The first concerns how user input can be used to improve screen design. This will be demonstrated in the final presentation by comparing the 'before' and 'after' screen designs. Secondly, Authorware provides good support for screen design. A single display icon can be used as a general design tool. This may then easily be broken into several display icons which can be added in sequence for effect or a layering concept. This design concept was used throughout the entire program.

d. The **user interface** is another area of importance. How easy is it to use? This area is obviously an area where end user input is essential. The way in which this problem was handled was twofold. First, the initial design drew upon my experience of teaching various groups of people over a number of years. Secondly, the program was exposed to users for their comments. This combination proved to be effective in the creation of the final design.

e. **Course content** must also be considered. This is mentioned in the Introduction. In producing this program, I determined to give an overview of the subject of theology which would give a basic understanding of the important concepts. The section on the Gospel was slightly more involved because of its importance and because it was the first section completed. I think that experience caused the later sections to be done in a more concise manner. The section on Eschatology only has a brief overview because of its complexity. It would have required a section about as large as the rest of the program in order to provide a good overview. I decided it would be better to do this in a separate program at some future date. The section on Ethics was added to provide the user with an opportunity to apply truth. It also gave me a good opportunity to demonstrate some more of the interactive capabilities of Authorware.

f. **Course flow** is of prime importance. This is mentioned in the **Story board** section. The major concepts of course flow used here were to keep it simple and consistent. The **Outline of this program** section demonstrates that this was accomplished.

g. The use of **graphics and animation** is also of interest. These need to be used in such a way as to help the learning process without calling attention to themselves. This is demonstrated throughout the program in two ways. First, the graphics themselves are simple in nature. This was done to demonstrate the simplicity of authoring a program and to enhance the learning process. Secondly, it is demonstrated in the response to users comments. Sections were changed to enhance learning rather than to show graphic capabilities. A simple example of this is the removal of the arrows from the end of the red lines. This is discussed in greater detail in number eleven of the **Responses** section.

5. **End user input** is essential. The end user sees the product differently than the programmer and thus offers invaluable assistance in the development of the product. This is discussed in greater detail in the **Responses** section.

3

3.0   Basic principles

This section describes basic assumptions which were used in the teaching methodology.

Limited use of text is the first principle. If teaching is to be accomplished through the use of reading text it would be easier to put in a paper format. Most people would rather read from a paper copy than a computer screen.

The second principle is that there should be a **high degree of user control.** Since there are such a variety of people who learn in many ways they should be able to control the flow of the program to some degree. This certainly has to be balanced but its importance is recognized. One of the areas where this is most obvious concerns the quiz at the end of each section. Various options are given to each user in order to provide them with a style which is most helpful to each individual. Another area for consideration relates to the decision to show particular sections for a set period of time rather than allowing users to choose when to continue. This may lessen the amount of control which the user has but the user may still easily repeat each section in question. This is demonstrated in the *Attributes* submodule under III-B-5.

Simplicity is the next principle used. This refers to at least two areas. There needs to be a consistency throughout the program. Users don't need to face continual surprises in the flow which may interfere with the learning. It is also necessary to make concepts as simple as possible without damaging the idea.

A certain amount of **variety** is balanced with the concept of simplicity. There should be a certain amount of variety in the techniques used. The techniques should also be the best means of conveying the concept.

4

4.0   Authorware Professional Description

4.1   General Description

This is a brief description of the basics of Authorware as it applies to the methodology used in producing this project. It is not an exhaustive description of Authorware. I believe that Authorware combines ease of use and needed resources to make it a good tool in designing a CAI program. It provides a good visual interface which provides good design capabilities. It also keeps the number of icons to a minimum which makes it easy to use.

Authorware uses a flow chart with several levels in order to construct a program. It is fairly intuitive as various icons may be placed in their appropriate sequence through the click and drag process. A description of each of the icons used follows.

The **display icon** is used to display any type of graphics and text. The items within a display icon may easily be split into multiple display icons for the purpose of layering or adding display on top of display. The default layering of the displays is to have the last display appear on top but this can be changed by designating the relative layer of each display. Another facet is the possibility of having several different effects for both displaying and erasing the icons. The display icon was the icon used most in the thesis program.

The **animation icon** is used to move the contents of any single display icon in a particular path. There are five different alternatives for types of paths which can be used. This project utilized the 'fixed destination' which moves the object along a straight line and the fixed path which moves the object along a path to a particular destination. The 'fixed path' may be a series of straight or curved lines. It is possible to control the speed of the object by designating speed or time of completion.

The **erase icon** allows for erasing all material contained in display icons. There are several effects available to erase the icons and it is possible to erase any number of the display icons which are currently appearing on the screen. This may be used to allow for displays to be erased in a particular order for an effect.

The **wait icon** is one of three icons (the others are the decision icon and the interaction icon) that allows the program to wait for a time period or an action. The wait option allows for either user response or a set time period to allow the program to continue. The time option is particularly helpful in controlling the flow of the program.

The **decision icon** allows for the selection of various paths in the flow chart depending on certain parameters. This may include a sequence of actions, a selection determined by the value of a particular variable or a random choice. The thesis program makes use of the random option.

The **interaction icon** allows for decisions to be made but these decisions are based on user input. There are ten different options for user input. This project makes use of three. These are clicking on buttons, clicking on certain hot spots and the entering of text. The interaction icon also may be used in the same way as the display icon. All display icon options are available from within the interaction icon.

The **calculation icon** essentially allows for certain programming which is not available from the other icons. It may be described as programming techniques. It provides opportunity for changing variables, if statements, random functions and several

other programming techniques. It may even serve as a place for inserting comments about the program.

The **map icon** provides for organizing the program. A group of icons may be placed inside a map icon. These icons provide for several levels and is useful for simplifying the program.

The **sound icon** provides for playing of sounds within the program. There are also **movie** and **video** icons available. Only the sound icon was used in this program.

Authorware also makes offers the option of storing display, interaction, calculation, movie and sound icons in an external **Library.** This is helpful for icons that are used more than once. They can easily be edited one time rather than many. Libraries can also be accessed by more than one Authorware Program. I did not make use of this option in the program.

The use of **variables** is also possible within Authorware. There are many program defined as well as user defined variables available. This program made use of both to provide for record keeping, display and program flow. The variables used by Authorware are global in scope. The types of variables offered are character, numeric and logical. Integers and non integers are both included in the numeric category. Structured variables are not used in Authorware although it is possible to write functions in various languages and call them from a calculation icon in Authorware.

4.2   Software Engineering Issues
Since Authorware is used to produce a piece of software, it is appropriate to discuss certain issues relating to software engineering. The issues of modularity, reusability and maintenance will be touched on here.

Authorware provides for **modularity** in a several ways. First, the graphic structure and the use of the map icon provide a natural way to keep certain functions in place. These maps can easily be copied and pasted anywhere in the program. One difficulty with this method of using modules is that all variables in Authorware are global and it is necessary to use them carefully. Secondly, modularity can be achieved by authoring several separate programs and calling one module from another. It is possible to return to the calling module as well as pass variables between modules. Another form of modularity available is the ability to write functions in a programming language and call them from the calculation icon. The use of the Library for storage of display icons also relates to this concept.

Reusability is a strength of Authorware in the CAI environment. Since it is likely that CAI projects provide many similar solutions, it is easy to merely modify certain of the graphic sections for new presentations. While this may not speak to total reusability it certainly can significantly lessen development time for new programs. It would be possible to develop a general model to be used in several presentations and then merely make changes appropriate to each individual lesson. Libraries can also be accessed from any number of Authorware programs.

Authorware programs can also be **maintained** fairly easily. The visual structure of Authorware provides a good way for documentation in the naming of icons. The ability to use the map icon to organize provides for easy access to the original program and thus update it with little difficulty.

6

5.0   Basic Flow

This section describes the general flow or outline of the module.

1. The top level is the main menu which offers the user a variety of choices. The user may return to this level at any time.

2. Each module is similar in construction with the exception of the Ethics and Future modules which offer only one choice in each module. All other modules present an initial option of two choices.

a. The user may choose to see a short animated description of the theological area.

b. The user may choose to see a more detailed discussion of the theological area.

1) The user may then choose to quickly go through a short text based description of the concept.

2) Each test based description offers the opportunity to see an even more detailed description of a related topic. These descriptions vary as to both length and type(e.g., text vs. animation).

c. Following the instruction section is an opportunity for a short quiz at the end of each module.

1) The user may take a quiz with no immediate feedback. The users score will be reported at the end of the quiz.

2) The user may take a quiz that allows continuation until a correct answer is chosen. The users score will be reported at the end of the quiz. This score relates only to the first answer chosen.

3) The user may take a quiz that provides immediate feedback. The users score will be reported at the end of the quiz. This score relates only to the first answer chosen.

4) The user may choose to look at the quiz with the correct answers given.

5) The user may choose to look at thought questions which discuss the relationship between theological and ethical concepts.

7

6.0 Outline of the module

This section provides a specific outline of the module building on the previous section which provides a general outline. The following outline is built from the main menu. Note that it is possible to easily go through the entire program without choosing any of the bulleted(•) items. They all provide additional information. Also, upon finishing a bulleted item the program continues to the next topic rather than returning to the current topic(e.g., upon finishing '• What is righteousness' under I-B-1 the program continues with I-B-2. It is also possible to return to the main menu at any time.

I. Gospel
- A. Short animated description of the Gospel
- B. Discussion of the details of the Gospel.
    1. All are sinners Rom. 3:10
        - • What is righteousness
    2. All are sinners Rom. 3:23
        - • Discussion of good people
    3. All are condemned Rom. 6:23b
        - • Discussion of those who haven't heard
    4. All are condemned John 3:17
        - • Treatment of sinners
    5. Christ died for all Rom. 5:8
        - • Why necessary
    6. Christ died for all John 3:16
        - • Is it the only way?
    7. Believe in Him John 1:12
        - • What is belief?
    8. Believe in Him John 3:16
        - • What is the gospel?
    9. Quiz
        - • Take quiz with no feedback
        - • Take quiz until right.
        - • Take quiz with feedback
        - • Answers to quiz
        - • Thought questions on ethics.

II. Bibliology
    A. Short animated description of production of the Bible
    B. Discussion of the details of Bibliology
          1. Overview of Bibliology
          2. Revelation Psalm 19:1
               • Natural revelation
          3. Revelation II Tim. 3:16
               • Special revelation
          4. Inspiration II Tim. 3:16
               • Implications of Inspiration
          5. Inspiration II Pet. 1:21
               • Process of Inspiration
          6. Illumination John 16:13
               • Different understandings
          7. Interpretation II Pet. 1:20
               • Principles
          8. Quiz
               • Take quiz with no feedback
               • Take quiz until right.
               • Take quiz with feedback
               • Answers to quiz
               • Thought questions on ethics.

III. Theology Proper
    A. Short description of the trinity
    B. Discussion of the details of Theology Proper
          1. Overview of Theology Proper
          2. Trinity Deut. 6:4
               • More information concerning the trinity
          3. Holy I Pet. 1:15
               • Holiness illustrated
          4. Love I John 4:8
               • Related to holiness and justice
          5. Distinct Genesis 1:1
               • Attributes
          6. Quiz
               • Take quiz with no feedback
               • Take quiz until right.
               • Take quiz with feedback
               • Answers to quiz
               • Thought questions on ethics.

IV. Christology
    A. Short animated timeline describing Christ
    B. Discussion of the details of Christology
        1. Overview of Christology
        2. Deity John 1:1
          • More information concerning the deity of Christ
        3. Union of two natures Phil. 2:6-7
          • More information concerning hypostatic union
        4. Atonement John 1:29
          • Substitutionary Atonement
        5. Resurrection I Cor. 15:4
          • Significance
        6. Quiz
          • Take quiz with no feedback
          • Take quiz until right.
          • Take quiz with feedback
          • Answers to quiz
          • Thought questions on ethics.

V. Anthropology
    A. Short animated description of people
    B. Discussion of the details of Anthropology
        1. Overview of Anthropology
        2. Image of God Gen 1:27
          • What does it mean?
        3. Fall of People - Physical death Gen 3:19
          • Consequences of the fall
         4. Fall of People - Physical death Rom 5:12
          • What is involved in spiritual death?
        5. Responsibility Eph 2:10
          • Believer's responsibilities
        6. Quiz
          • Take quiz with no feedback
          • Take quiz until right.
          • Take quiz with feedback
          • Answers to quiz
          • Thought questions on ethics.

VI. Pneumatology
    A. Short animated description of the Holy Spirit
    B. Discussion of the details of Pneumatology
        1. Overview of Pneumatology
        2. Person not force John 16:8
            • Convicting ministry
        3. Deity Gen. 3:19
            • Additional information
        4. Work in producing salvation I Cor. 12:13
            • Other Activities
        5. Work in Christian living I Cor. 12:11
            • Other Activities
        6. Quiz
            • Take quiz with no feedback
            • Take quiz until right.
            • Take quiz with feedback
            • Answers to quiz
            • Thought questions on ethics.

VII. Soteriology
    A. Short animated description of the process of salvation
    B. Discussion of the details of Soteriology
        1. Overview of Soteriology
        2. Option to see a review of the short section on the gospel.
        3. Justification Rom. 4:2-3
            • Additional information
        4. Sanctification I Cor. 6:11
            • Additional information
         5. Glorification I John 3:2
            • Additional information
         6. Security of the believer Rom. 5:9
            • Additional information
         7. Quiz
            • Take quiz with no feedback
            • Take quiz until right.
            • Take quiz with feedback
            • Answers to quiz
            • Thought questions on ethics.

VII. Eschatology
    A. Other literature
    B. Short animated timeline of the future

VIII. Ethics
    A. Underlying concepts
    B. Explanation
        • Your answers
        • Program answers
    C. Problem One
    D. Problem Two
    E. Problem Three

7.0   Use of Authorware in the program

This section describes the way in which Authorware was used to solve specific design problems.

7.1. Organizational Issues

A. The initial problem relates to the ability to return to a main menu from any place in the program. Authorware provides an easy solution for this. It is only necessary to set up a perpetual interaction icon which allows for clicking on the <main menu> button in order to return to the main menu from any location. An erase icon makes sure all other display icons disappear when returning to the main menu. It is necessary to ensure that the <main menu> button is not erased at any point in the program. Although the option is perpetual it is possible to erase the button.

B. Under the section (II-B-5) module the question "What process did God use?" I decided to show the *Quick* section of *Bible* module. Rather than repeating it by using a series of icons stored in a Library I used a Boolean variable and the built in GoTo function. The *Quick* section makes use of an if statement regarding the Boolean variable. If it is True the program returns to the *Inspiration of Scripture* section. If it is FALSE the program continues normally. The Boolean variable is changed back to FALSE upon its return. All variables are initialized when the Authorware programs starts. This technique is also used in other places throughout the program where it was desirable to use a particular section more than once. These include the following places. 1) Submodule *More information concerning the trinity* under III-B-2. 2) VII-B-2.

C. Under the (IV-B-3) section the submodule *More information concerning hypostatic union* uses a modification of the timeline used in the *Quick* section. It uses the Boolean variable to not only show the section again but to also skip certain parts of it which are not applicable to the new section and to add certain parts which are applicable. This is similar to the immediately preceding section(B).

7.2. General design Issues

A. The quiz sections are the same in each of the areas and provide interesting areas for comment.

1. Each answer in the Authorware flowchart is marked with a plus sign(+), designating a correct answer or a minus sign(-) designating an incorrect answer. It then becomes possible to use Authorware's built-in variable FirstTryCorrect to determine the number of correct responses a user gives in each of the sections. The percentage is then figured in a calculation icon and then shown in a display icon. It would be possible to actually perform this calculation directly in the display icon but the calculation icon was also used to reset variables to zero. To display the value of a variable in a display icon the name of the variable is enclosed in curly brackets{ }. It is possible to perform a calculation involving more than one numeric variable within the brackets. The result of the calculation or variable will display.

2. The various flow chart path selection options under the interaction icon are also illustrated here. All of the possible quiz options make use of the 'Exit Interaction' choice which causes the immediate continuation of the program regardless of the choice. The second quiz option which requires a correct answer also makes use of both the 'Exit Interaction' option (for correct answers) and the 'Try Again' option (for incorrect answers) which causes the program to loop back to the current interaction icon.

3. The section which asks thought questions regarding ethics allows for user input making use of the text entry option. In this area it is possible to require a specific match in order to continue. In this instance the use of the wild card(*) as the icon title allows for any answer to be a match and thus continue. The response is saved as a variable using the built in variable EntryText to get the answer. This answer can then be displayed elsewhere in the program. It is displayed immediately following its retrieval as well in the final Ethics section of the program.

4. The thought question section makes use of the decision icons. It is used to give a random encouraging comment to the answer which is given. In this case there are six possible responses which may be given. The decision icon gives a random response.

B. The issue of being able to show two previous sets of answers in the *ethics* module was another problem. The difficulty related to moving back and forth between the answers and various other sections. This was accomplished in two ways. First, the choices to view the answers were made active when a particular Boolean variable was set to True. This would be set to True when in the Ethics module and False when leaving it. Another variable would be defined when each section was entered in order to return to the proper place from the list of answers.

7.3. Visual Effects

A. Section of the (I-A) deserves a brief comment. Since this section was done first there are things that were developed differently later but this section remained in to demonstrate different approaches. When doing this section I was unable to figure out how to have text move across the screen so I rather placed it in different locations on the screen. Another item of note is the use of the timer in the bottom right corner of the screen to let users know that this section would time out. This timer is an option available within the wait icon. Upon further reflection and comment from users, I decided that the original option of not moving text across the screen provides for variety in the program and is thus desirable.

B. Under section (I-B-3), the response to the submodule *Discussion of those who haven't heard* demonstrates the use of both the 'fixed destination' and 'fixed path' options of the animation icon. These techniques are the ones used wherever animation occurs during the presentation. The 'fixed destination' moves the contents of a display icon from one location to another in a straight line while the 'fixed path' moves the contents of a display icon from one location to another in a path which may contain a series of straight and/or curved lines.

13

C. Most major detailed sections are preceded by a series of animations which place four puzzle pieces together in a whole puzzle. The reason for this is to demonstrate how the parts to be discussed fit into the whole. This was produced by beginning with one display icon and drawing a rectangle. The pieces were then drawn over the rectangle and cut and pasted into their own display icons. It was then simple to use four animation icons to move the four pieces into their proper location.

D. Under the (III-B-3) section the submodule *Holiness illustrated* there is an animation which uses the illustration of light to reveal a man standing in darkness. This was accomplished by assigning different relative layers to three separate display icons The darkness display icon was assigned the default level, the man display icon was assigned level one and the light display icon was assigned level two. The man display icon initially does not appear since it is the same color as the darkness display icon but as the light display icon is animated it moves over the darkness display icon and under the man display icon causing the man standing in darkness to be revealed by the light. The concept of using different levels is also used in the following submodules. 1)*Convicting ministry* under VI-B-2. 2) *Other Activities* under VI-B-4 3) VI-A.

E. Under the (III-B-4) section the submodule *Related to holiness and justice* words appear and disappear as an oval descends from the top to the bottom of the screen. This was handled by making the words the same color as the background. When the animated oval was over them they could be read but when it did not cover them they blended into the background. This layering technique is also used in the following place. The submodule *More information concerning hypostatic union* under IV-B-3.

F. The animated timeline appears several places in the project. It is essentially a series of animated display icons which proceed in sequence. The problem of moving text across the screen is solved in the following manner. Text originally comes up in a display icon where the text displays off the visible screen. An animation icon causes the text to move across the screen and it is erased after it has crossed the screen. Animated timelines appear in the following places. 1) the submodule *More information concerning hypostatic union* under IV-B-3. 2) VII-B. 3) IV-A.

G. Another technique which was used in several places involves the use of color to show relationships between the Bible and ideas. The text of the Bible passage originally appears in black but the appropriate portion of the passage changes color to match the idea appearing on the screen. This is accomplished by superimposing the colored text in a new display icon over the old text. The entire passage is superimposed over the old since it is much easier to copy the entire passage into the same place on a new display icon. This technique is used in the following submodules. 1) *Other Activities* under VI-B-5. 2) *Additional Information* under VII-B-3. 3) *Additional Information* under VII-B-4. 4) *Additional Information* under VII-B-4.

H. An interesting problem occurred in the *Quick* section of the *Salvation* (VII-A) module. Here it was necessary to place the sinner into the hand of God and then move the two together. The difficulty was that Authorware only moves one display icon at a time. In order to accomplish the desired effect it was necessary to superimpose a new display icon containing the sinner in the hand of God directly over the two other display icons. The covered icons could then be erased and the new icon could then be moved in the desired manner.

14

8.0 Responses

This process was possibly the area where the greatest learning experience took place. I was aware when I began the project that this would be a necessary part of it. I was not expecting that it would be as helpful as it was. The interesting aspect of this was that the suggestions were not really major changes in content or logic but rather more subtle changes which greatly increased the benefit to the user.

The program in its initial form was given to five end users for their comments resulting in the changes described below. These users included three men involved in Christian ministry, one English teacher and one user who would not be as accepting of the content of the message and thus provide feedback on the methodology.

I was not specifically surprised by any of the individual changes which made. Rather, I was surprised by how helpful they were and how much subtle changes helped the program. I was convinced by the users that all the changes made were of value.

8.1. Organizational Issues

A. The placement of the buttons was changed. They were lowered to the bottom of the screen and their order was changed. The <Previous> button was moved to the left and the <Next> and <Continue> buttons to the right. The problem here was twofold. First, when I developed the program I included the menu bar at the top. When I was ready to use it I removed the menu bar which caused the buttons to appear higher on the screen. It was necessary to lower them. Secondly, it was suggested that it was logical to think of previous as being on the left and next on the right.

B. The navigation through the submodules was changed. Submodules refers to the bulleted items in the outline. <Continue> buttons were substituted for <Next> buttons. The navigation goes either directly forward or backward one screen rather than jumping back to a major display. Originally, when in the submodule it was possible to jump back to the preceding major display(e.g. when in • What is righteousness under I-B-1 it was possible to return to 'All are sinners Rom. 3:10' at any time) This was changed to proceed through the submodule one area at a time. When the submodule concludes it moves to the next item(in this case I-B-2). This appears to be less confusing for the user. There is a subtle distinction between <next> and <continue> buttons which may or may not be lost on the end user. Next refers to navigation within the main modules while continue refers to navigation within the submodules(the bulleted items in the outline).

C. A <previous> button was also added to the section where quiz options could be chosen. Originally it was impossible to go back to the previous screen from this section. The user could only return to the main menu or use one of the quiz options. This limited the user control of the module.

8.2. General Design Issues

A. Some of the erase effects were changed. The project was developed on a Power Mac 8500 and effects that were managed well on that computer did not do as well on less powerful computers. The 'fade' and 'build' effects were found to be the most effective.

15

8.3. Visual Issues

A. The Main Menu page was changed in regard to its appearance. Rather ugly colored rectangles were replaced with buttons, text was left justified rather than center justified, and the title was made more readable and attractive. This was done for two reasons. First, the attractiveness of the screen is important. Secondly, it was initially difficult to know exactly where to click. The first menu screen on each individual topic was changed in a similar manner. A <Quit> button was also added as there was originally no obvious way to exit the program.

B. The design of the text only screens was changed. These are most of the screens designated by the arabic numerals in the preceding outline. There are four major sections included in each of these screens. They are a title, a Scripture verse, an explanation of the Scripture and a button offering further information about a particular aspect of the subject. Originally each of these sections had its own box. The boxes were not pleasing to the eye and it was difficult to know which were buttons and which were not. The original boxes were removed and a more obvious button was added for the selection to see more information. The color scheme was also enhanced.

C. Buttons were added to all of the sections where a user could make a choice concerning which quiz option would be followed. Originally the section only had text which asked the user to click on it. This was confusing and was changed by adding buttons next to the text.

D. The manner in which charts were used was changed. An example of this may be found in the *What is the Gospel?* submodule under 1-B-8. Originally the red, horizontal, separation lines had arrows on both ends. This confused the user who may think that it is directional. The arrows were removed. Originally, there was also a vertical line separating related ideas. In order to make the relationships more obvious the vertical lines were replace with small horizontal arrows designating relationships. This technique is also seen in the following submodules: 1) Natural revelation under II-B-2. 2) Different understandings under II-B-6. 3) Principles under II-B-7. 4) More information concerning the trinity under III-B-2. 5) More information about the deity of Christ under IV-B-2.

8.4. Issues to enhance understanding

A. Changes were made in the submodule *What is righteousness?* under I-B-1. The original graphics were confusing. The user might consider the graphic to be a button. The entire screen was redone to better make the point and avoid confusion.

B. Some changes were made in the 'jigsaw puzzles' in the overview sections. The idea to be conveyed is that several pieces fit together to make the whole. It is necessary to see the whole before it is truly possible to understand the individual pieces. The change which was made involved outlining each piece to emphasize its individuality and then 'erasing' the outlines after they are fitted together in order to emphasize the unity. Originally the pieces were not outlined.

C. The initial animation in the submodule *More information concerning the deity of Christ* under IV-B-2 was meant to picture that the concept of the deity of Christ rises out of the concept of the trinity. Originally the graphic depicting Christ's deity was superimposed over the Father. Since this could lead to a wrong impression one animation icon was deleted to correct it.

16

D. The Explanation screen in the Ethics section was changed in order to give a better understanding of what is meant by "your answers" and the "program's answers."

E. Changes were also made in the I-A section. This section is discussed previously under the **Use of Authorware in the program** section #2. The change occurred in the placement of the next button. Originally, the placement of the text was not well organized and it was of varying size, color and font. The placement color and font were made uniform and old text was grayed as new text appeared.

8.5. Language Issues

A. In IV-B-2 he phrase 'very God' was changed to 'completely God'. This is of interest because it illustrates the use of terms which may not be understood by the ordinary end user. Whenever a term which may not be easily understood is used it must be determined whether it should be omitted or explained. Some terms should be explained while this phrase could easily be omitted.

B. Various errors in grammar and spelling were changed. This shows the value in choosing an English teacher to review the project. Consideration should be given to choosing users to test the module who will have different perspectives.

9.0   Possible future considerations

An interesting observation about a computer assisted instruction module is that there will always be new ideas for change and improvement. It would also be easily possible to do a thesis on any of several areas which were a part of this project. These include Initial planning, screen design, evaluation, and teaching techniques.

One future consideration is to save certain user inputted responses. Currently, the information is lost upon conclusion of the program. It would be possible to save the information and associate it with a particular name the next time the program was running. This could include scores on the quizzes as well as the responses to the questions on ethics.

Another observation has to do with the cross platform issue. It is possible to author on a Macintosh and transport to a PC environment but not vice versa. One of the major considerations in doing this is to be aware of what will cause difficulty in transporting the product. Two that are relevant in this module are to be aware of fonts which are used and to be aware of the format of different graphics.

Another related area is the different size screens which may be used in the final version. Authorware may be developed for different screens. The author needs to be aware of this.

A more formalized evaluation procedure might be of value. The procedure I used was very useful but it would also be useful to develop a more formal evaluation which might make use of naive groups and compare learning using alternative instruction methods. I believe that this is beyond the scope of this project and could easily be a thesis by itself.

10.0   Annotated Bibliography

1. Rada, Roy; Deakin, Anthony G; Beer, Martin D. "Collaborative development of courseware: Part one -- examples." Intelligent Tutoring Media (May 1, 1993) v4 n2 p59-68. This article provided some basic design ideas which were used in the design of the module. They include aims, strategy, and the use of a storyboard.

2. Michailidis, Antonos; Rada, Roy; Deakin, Anthony G. "Collaborative development of courseware: Part two -- computer coordinated coordination." Intelligent Tutoring Media (May 1, 1993) v4 n2 p69-77. This article was especially helpful in that it gives a good overview of the process needed in the development of a Computer Assisted Instruction module. It provided a valuable basis for the development of the project.

3. Zehavi, Nurit. "Supporting an active role for the teacher in computer assisted learning" Journal of Technology and Teacher Education (December 1, 1993) v1 n4 p353-372. While this article did not have a direct relationship to my project it certainly contains many interesting ideas. This article relates to the idea of feedback to the instructor as students work through a computer assisted instruction module. My project is related to students using a module on their own. It does contain some useful concepts related to goals and techniques.

4. Whyte, M.M.; Karolick, D.M.; Nielsen, M.C.; Elder, G.D.;Hawley, W.T. "Cognitive styles and feedback in computer-assisted instruction." Journal of Educational Computing Research, vol.12, no.2, p. 195-203. This article focuses on studies in the use of feedback. It contains several interesting ideas about the importance of feedback and the concept of adapting teaching to the learner rather than forcing techniques on the learner. This relates to allowing user decisions within a module. A good bibliography is also included.

5. Park, Seungbae. "Implications of learning strategy research for designing computer-assisted instruction." Journal of Research on Computing in Education (June 1, 1995) v27 n4 p435-456 This article provides an interesting overview of several learning strategies as they relate to both CAI and learning in general. The concepts which were of specific interest were differing types of questions and summarization. The types of questions include adjunct questioning and reflective questioning. Summarization is primarily related to student comprehension but may also relate to designing simplicity into teaching modules.

6. Kerth, Thomas. "Four Decades of Call: A Collected Bibliography." CALICO Journal v12 n4 p144-155. This provides an interesting bibliography of CAI over the years.

7. Shute, Valerie J; Regian, J Wesley. "Principles for evaluating intelligent tutoring systems" Journal of Artificial Intelligence in Education (June 1, 1993) v4 n2/3 p245-271. This article provides a discussion of evaluating CAI systems. It provides for controlled evaluations of CAI modules. I used more informal means for testing this module.

8. Wong, Carolyn W C "Will CBT solve your training woes -- Once oversold, computer-based training now deserves a second look. It's expensive to get into, but here's how to make it a sound" Open Computing (November 1, 1994) v11 n11 p58- 63. A more popular treatment offering an overview of CAI but still thought provoking concerning value of CAI.

19

9. Kashy, E.; Gaff, S.J.; Pawley, N.H.; Stretch, W.L.; Wolfe, S.L.; Morrissey, D.J.; Tsai, Y. "Conceptual questions in computer-assisted assignments" American Journal of Physics, vol.63, no.11, p. 1000-5. This article is related to teaching Physics but still raises some interesting points about qualitative questions. The questions about ethics at the end of each section relate to this concept.

10. Schoaff, Eileen Klimick. "How to develop a mathematics lesson using technology" Journal of Computers in Mathematics and Science Teaching (January 1, 1993) v12 n1 p19-27. This article primarily relates to letting students develop their own lessons but is valuable in thinking about the relationship of software capabilities and the types of material which may be taught.

11. Hiltz, Starr Roxanne. *The virtual classroom : learning without limits via computer networks* Norwood, N.J.: Ablex Pub. Corp., c1994. Discusses a variety of ways in which computers may be used in learning.

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13. Tufte, Edward R., *.Envisioning information* Cheshire, Conn. : Graphics Press, c1990. This book provides some excellent ideas concerning design as it relates to the way things look. I am particularly interested in the section on color. My struggle with color convinced me of the importance of understanding it.

11.0   Additional Bibliography

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Appendix - Display of Authorware Icons

abc

Display icon

Animation icon

Erase icon

Wait icon

Decision icon

Interaction icon

Calculation icon

Map icon

Movie icon

Sound icon

Video icon