DESIGNING INTERACTIVE INSTRUCTION

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Abstract

You have been asked to develop a computer-based training course (CBT) for your organization. Where do you start? What design principles do you apply to make your CBT course both effective and motivating? Or maybe you are responsible for acquiring computer-based training courses for your company. How do you recognize a CBT course that is well designed? High quality CBT courses are developed through careful planning and structured design. Structured design promotes CBT that is interactive and tailored to an individual’s needs. Structured design also helps prevent the production of computerized “page-turners” where pressing the ENTER key is the only required interaction built into a course. This paper provides you with the specific steps to follow in a structured design approach to computer-based training.

If you use authoring systems to develop CBT courses, you will find that the structured design approach works particularly well. If you coordinate or select CBT courses for your company, you will find this information useful for evaluating the potential effectiveness of a CBT course.

Introduction

The mistake is a common one. A CBT course is being developed and the course designer has jumped from writing a course outline to producing the final course screens on the computer. The first few days of development go smoothly; then the designer begins to get lost in the details of each screen and increasingly forgets to incorporate branching, remediation and other forms of individualized instruction that make CBT such a powerful training medium. This method of CBT course development most often leads to instruction that is improperly planned and increasingly linear in design as the course progresses.

It is important to remember that with every training course, regardless of the medium used, you should plan your instruction in detail before you actually produce the course materials. In the case of computer-based training, preplanning allows you to think through the instruction, making the best possible use of computer resources and instructional design principles.

This paper describes an organized method of preplanning, a structured design approach to CBT course development. The key to this approach is the process that occurs before you sit down at the computer to enter your instruction; you implement structured design after writing your goals and objectives for a course, but before you enter any instruction on the computer (see Figure 1.)

Figure 1. The Course Development Process with Structured Design

A structured design approach to CBT development has several advantages. First, the entire course is planned before any keying of material is done on the computer. This affords you the opportunity to look at your course as an integrated unit, one that accomplishes the training goals you have established. With this type of preplanning, you develop an efficient and organized flow of instruction so material is not repeated or overlapped unnecessarily.

Second, your course is written and tested in levels. You create these levels by breaking down the instructional tasks in your course into subtasks. These subtasks become discrete instructional units that are easy to test and revise.

Third, if you plan to use an authoring system to enter your instruction, you can make maximum use of its capabilities by preplanning your course. A well-built authoring system will allow you the freedom as a course designer to incorporate almost any type of branching or remediation into your instruction. By preplanning your CBT course, you have the chance to match your course design with an authoring system that freely allows you to accomplish your instructional goals.

The Steps in Structured Design

There are six basic steps that you should follow for structured design of CBT courses. The first three steps should be completed for the course as a whole. The second three steps should be completed for each unit in the course (that is, for each lesson).

1. Develop the instructional strategies for the course.

2. Write a brief description of the course and its units.

3. Outline the main instructional logic of the course.
(Then complete the following for each instructional unit.)

4. List the names of screens, variables, and other naming conventions used.

5. Outline the instructional logic screen by screen.

6. Enter the instruction on the computer, testing as you go.

Some additional explanation can be provided for each of these steps.

STEP 1 Develop the instructional strategies for the course.

Once your course objectives have been written, you should plan the instructional strategies for your course. First, classify your instructional objectives and list them so that the behaviors they ask for build upon each other. Your instructional material should progress through facts, concepts, rules, procedures and, finally, to problem solving.

Classifying objectives helps you to decide how many examples, how much practice, and what kind of feedback you should use for a particular segment of instruction. For example, memory-level objectives (such as, name, list, identify) are well suited for drill and practice instruction because they require repetition of the same facts over and over again. Objectives requiring the learner to distinguish between concepts (such as, classify, discriminate) are handled well with tutorials where a series of examples and nonexamples can be shown. Objectives that require the learner to use a set of sequential operations or steps (such as, rules) to solve a problem are most efficiently addressed with tutorials that provide learners with formulas, then simulations that ask learners to solve problems in a particular situation. Figure 2 outlines the instructional strategies for two different types of objectives.

<table>
<thead>
<tr>
<th>Behavior</th>
<th>Classification</th>
<th>CBT Segment</th>
</tr>
</thead>
<tbody>
<tr>
<td>identify a correctly written INPUT statement</td>
<td>memory-level behavior</td>
<td>short drill where student identifies correct and incorrect INPUT statements</td>
</tr>
<tr>
<td>distinguish column, list and formatted INPUT statements</td>
<td>concept-oriented behavior</td>
<td>tutorial with examples and non-examples of each type of INPUT statement</td>
</tr>
</tbody>
</table>

Figure 2. Instructional Strategies for Two Types of Objectives

STEP 2 Write a brief description of the course and its units.

After you have your instructional strategies outlined, you should write a paragraph briefly describing the course and each of its units such as, lessons, modules) in English. This effort is by no means wasted. It forces you to think about your instruction as an integrated package instead of as individual tasks. You get a good chance to look at the instructional path you are planning to take your students down, that is, what skills they will start with and what skills they will end up with. Figure 3 shows sample descriptions for a course and a course unit, in this case a module. You should describe each of the units of your course in a similar manner.

Description of Course

This course is the second in a series of introductory computer-based courses that teach the base SAS® software to a beginning SAS user. In this course, you learn new ways to create and process SAS data sets using the SAS Display Manager System, a full-screen facility that allows you to interact with all parts of your SAS job.

Description of Module 1

Module 1 teaches you how to create SAS data sets by reading data using three different input modes. You also learn how to read data in-stream and read multiple records per observation. You practice interpreting the SAS log to identify and correct errors in SAS statements included in the DATA step. Module 1 will have four lessons.

Figure 3. Sample Descriptions of a Course and One of its Units

STEP 3 Outline the main instructional logic of the course.

In this step you create a flowchart of the instructional units of a course, showing how they all fit together. This is an excellent time to decide if you will have any precourse and postcourse materials and, if so, to decide how they will fit into your course. You should plan which screens students will see when they first enter your course, and you should decide which instructional unit students will end with. This is also a good time to decide if you will keep any course performance statistics on each student, and if so, how they will work. Figure 4 shows a sample instructional flowchart for a course containing three modules.
Figure 4. A Sample Instructional Flowchart for a CBT Course

Once you have your course organized into a distinct set of units you can complete the last three steps of preplanning. These steps (4 through 6) should be completed for each course unit.

STEP 4 List the names of screens, variables, and other naming conventions used.

This step is often overlooked until it is too late. For single course units, it seems easy enough to remember the purpose of a variable you assigned or what you named a certain segment of instruction. However, entire CBT courses often involve scores of names and abbreviations, and it usually becomes an impossible task to remember what each means. This problem can be helped by maintaining a list of the names you plan to use in each course unit. In addition, preparing this list before you begin entering instruction helps you to check for duplicates and mismatches in the names you have selected. It is also helpful if your list of names includes corresponding descriptions to help you remember the functions of each variable or why certain names were chosen. This list can be a valuable aid to you for revising or updating your course materials. It can also provide assistance to other designers who may need to work with your course materials at some future date. A portion of the naming list for a lesson is shown in Figure 5.

STEP 5 Outline the instructional logic screen by screen.

The major portion of time designing the course should be spent with this step. It involves creating an instructional flowchart in a manner similar to the list described for STEP 3. Here, however, you create a flowchart for each course unit. You should outline each screen in a unit in detail, documenting the questions you will ask and the actions to be taken for each possible response. This is the best time to make sure that your objectives match your test items and to show how a student will be remediated if they fail to answer a question correctly. Keep in mind that this step is where you have the most opportunity to use the power of the computer wisely; this is where you plan the branching and remediation that creates individual learning paths for students taking your course. Part of a flowchart for a lesson might look like the one shown in Figure 6.

As you outline your instruction, you should also pay attention to how you will enter the final course screens on the computer. Those of you who will use an authoring system, should look for ways to use the unique features of that system in your course. Those of you who will code your instruction using some programming language should make sure that your screen sequences have been outlined in enough detail so that no logical decisions are left to make as you are coding.
The Results of Structured Design

Structured design promotes the development of high quality CBT that is well organized and designed to accomplish the instructional goals you have set. With structured design, you can develop computer-based training with:

- individualized learning paths capable of accommodating learners at many skill levels and with many learning styles
- a minimum of structural and/or logical errors
- organized, coordinated instructional units that are easy to relocate and revise if needed.

The structured design approach helps to ensure that the proper conditions are present for learning with an interactive medium such as the computer.

Figure 6. A Sample Instructional Flowchart for Part of a Lesson

STEP 6  Enter the instruction on the computer, testing as you go.

If you have followed all the previous steps with conviction, this step will be the easiest of all to accomplish. You use your instructional outline to guide you through the development of each course screen, linking the screens in a unit together and testing them as you go. The preplanning process you have gone through allows you to be confident of the integrity of your instruction. You also know at any time exactly where a certain screen fits into your course plan.