Educational Courseware: Instructional Design Links to Learning

By Amit Schitai,
Multimedia Design Specialist, Long Beach City College

Introduction

As technology is being integrated into class curricula and more on-line courses are offered in many educational institutions, there is a need to examine the ways technology is used in these courses and to recognize the ways technology could positively affect students' learning. **Information, computation**, and **multimedia** are three popular components found in educational courseware. In many cases, courseware programs include these components by making use of the computer's operational capabilities, however instructional design considerations need to be applied to each one of these components to ensure learning has indeed occurred.

When using the computer operational capabilities to provide information, computation and multimedia, it is important to recognize three premises:

1. Delivering information ` learning
2. Provide performance computation ` learning
3. Including multimedia in the course ` learning

Table 1 describes how instructional design principles can complement the operational capabilities of the computer to ensure learning (click on each one for a discussion)

Operational Capability	Instructional design link to learning
Information delivery	Design information processors / strategies
Performance computation	Provide individualized feedback
Multimedia	Define media combinations and interactivity level

Information delivery – **passing on information does not mean that learning has indeed occurred**.

Courseware of various types (e.g. linear presentations like PowerPoint, non-linear courseware, Web pages used to facilitate class and on-line courses) often provide learners with screens full of information and students are required to scroll down pages or click on buttons to go through the material delivered their way. However, the fact that material was delivered is not enough to assume that learning has indeed occurred; there is no guarantee that students have successfully processed the information and retained it. To acquire information and learn, students need tools with which they can process the information passed on to them.

Information delivery instructional link: **Designing information processors /strategies**

The tools designed to help process information have to address a variety of individual differences among the learners. Some of these individual differences include concentration level, quantity of information, different background, ideas or habits students bring into the learning environment, and different learning styles, strategies and tactics. For any information provided, processors need to be designed to help the students learn the material. These processors include motivational and creative strategies that enable students to handle the material in various ways. Using the information processors, students spend appropriate time learning the material, become active participants while processing the information and thus they are able to retain the information.

Different types of courseware require different methods. Table 2 illustrates examples of various strategies and hierarchizes them on a scale ranging from "Unknown Learning Outcomes" to "Sound Learning Outcomes".

Table 2:

Unknown Educational Outcomes ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ Sound Educational Outcomes	**Information Delivery**	
	Method	**Examples from courseware**
	Turn Page	• Watch… When you are ready, click Continue • Read the following… • Read my explanation
	Browse	• Click to select a menu option • Find information about … • Search for ... in this picture gallery
	Analyze	• Drag and drop in the appropriate place • Set appropriate sequence • Identify … in this picture by clicking on it
	Do - Accomplish a task	• Mix the appropriate solutions to get …. • Ask for directions and navigate your way based on the answers
	Be – Take a role	• You are an Alaskan Salmon. What do you want to do next? • You are an ER physician. A patient in a coma has just arrived. What are you doing next?

Turn page methods are teacher-centered and generate mainly unknown learning outcomes. In order to achieve learning, students who are approached with this method are required to create their own strategies since none other are provided by the teacher.

Browse methods give students navigational responsibilities, however it is quite questionable whether learning has occurred. First, students may spend more time browsing than processing information they find. Second, even if students find relevant information, that information still has to be processed and retained.

Analyze methods require students to perform only after considerable thinking. Working with these methods, students are more likely to generate sound learning outcomes since they have to process bits of the information and interact with the material.

When using **Do** or **Be** methods, students are assigned a role or a task while working with the program. In this manner, students follow paths that specifically address their learning choices and needs. These methods ensure that learning occurs. Using them, students are more likely to be able to apply their new knowledge to other related areas. A few examples of Do or Be methods that I used in courseware I designed for various courses in Long Beach City College are:

• Taking the role of a young New England girl who was captured by Natives in the 1700s – to learn intercultural sensitivity theory.

• Auditioning for the role of Cosette – to learn past tenses in French.

• Managing a CD store – to learn how to use Excel absolute and mixed cell references.

• Working with music "makers" – to learn the Sonata Allegro Form

• Interviewing guests on a talk show – to practice grammar (for ESL students)

Performance Computation – reporting on students performance does not mean that learning has indeed occurred

Since computation is what computers do best, it is very natural for courseware developers to use this capability as a performance analysis tool. Thus, many courseware programs include a quiz or a similar assessment engine and then provide feedback like: "You have answered 14 out of 20 questions correctly." Some programs make use of the computer's ability to compute time and add to the previous assessment "in 3 minutes and 45 seconds." Providing computation to analyze students' performance, the programs function as merely a delivery agent rather than a learning resource. In this way, the programs are similar to a letter with GRE scores, or a blood test result – the recipients of these letters get the facts but no advice is provided about what to do or how to improve the situation. Students still need an analysis tool to understand what they did wrong and what is necessary to improve their performance.

Performance Computation instructional link: Providing individualized feedback

In order to understand and correct problems in their performance, students need feedback. The feedback has to be tailored to specific mistakes. It must also attempt to analyze the learners' thinking process. Interestingly, *feedback in a non-linear environment is in fact the "content" or the "overview information" in a linear environment.* Converting a traditional course to a courseware program by designing lectures and then administering quizzes would not guarantee sound learning outcomes. Instead, using a non-linear design, students who are asked to accomplish tasks within an

environment perform according to what they find necessary to their own learning. In such environment, both correct and incorrect responses result in an individualized feedback relevant to each student's performance and needs. Thus, retention of the material is higher and students progress gradually based on past performance and current needs.

Different problems require different types of feedback. Table 3 below illustrates a few types of feedback and hierarchizes them on a scale ranging from "Unknown Learning Outcomes" to "Sound Leaning Outcomes".

Table 3:

Unknown Educational Outcomes ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ Sound Educational Outcomes	**Performance Feedback**	
	Types of feedback	**Examples from courseware**
	Stating	• Your grade is B-. You correctly answered 15 out of 20 questions in 20 minutes and 34 seconds. • No, Try again
	Informing	• Incorrect, click here to review chapters 12 and 19
	Correcting	• Incorrect, the right answer is …
	Reinforcing	• Correct, because when doing … it becomes clear that …
	Directing	• Incorrect, click here to practice this element.
	Analyzing	• Incorrect, you are right thinking that … but notice the ….
	Resulting	• Lab explodes • Patient dies • $1m is added to your bank account

Often, courseware programs provide **stating** feedback such as "No, Try again" along with a score. "No, Try again" would be completely unacceptable feedback in a class situation and it is just as useless when used in courseware. In class, instructors usually analyze their students' incorrect response and understand how and why they erred. Then, instructors decide on the best approach to handle such mistakes, e.g. shift discussion topic, give a hint, provide the right answer or ask another question. The same process should be designed into courseware.

The "No, Try again" feedback is used so often in courseware because it furnishes programs with a way to address a large audience in a very small programming effort. However, this programming

convenience is not enough to ensure sound learning outcomes; what students learn from a generic feedback beyond the fact that they were wrong remains unknown.

Informing and **correcting** feedback merely look for learning shortcuts. Again, these types of feedback take advantage of the computer's operational ability to compare and compute numbers; however, such feedback amplifies the problematic nature of information given to students without being processed as discussed in the previous section of this article.

A solution which will ensure sound learning outcomes should use the computer's capability of addressing a large number of students in individualized manner, making the students feel that they are addressed individually and not as a crowd. Provided with a combination of **reinforcing**, **directing**, **analyzing** and **resulting** feedback, students' performance is analyzed in an effective way that ensures sound learning outcomes. Addressing the students in an individualized manner based on their individual responses makes the students feel that the computer "understands" what they need, and therefore they can rely on it to support their learning.

Multimedia – Including multimedia in courseware does not mean that learning has indeed occurred

Educational courseware programs often include images, sounds and movies. Unfortunately, in many instances, the inclusion of media in the courseware has very little effect on learning. Displaying a picture, for example, because "it's cute" or because it breaks a text segment does not mean that students learn better with it.

Analyzing the characteristics of each medium leads to many potential learning hurdles. Video grabs students' attention, however, it is a very passive medium. After a short time of watching video, students' concentration level and interest often decreases. Learning from audio is quite difficult; it requires concentration, internalization and processing skills that in many cases are not easy to apply. Additionally, audio requires a high level of imagination and creativity that is not common to all students. Images often require assistance in processing the information conveyed in them. Long text segments are hard to read on the screen and very difficult to retain.

Multimedia instructional link: Determining suitable media combinations and interactivity level

To ensure that learning occurs, media combinations (e.g. text and audio, video and text w/o audio) need to be designed for specific activities in the courseware. The media combinations correlate with the methods used in the courseware and create the interactivity.

Notice that interactivity can occur in class regardless of the use of media. Instructors plan specific parts of their lessons to elicit student performance, to collaborate in problem solving tasks, to develop critical thinking, to interact with each other, etc. In courseware, interactivity levels are determined based on the program design, the learning strategies, the selected media combinations, the feedback, and the ways students interact with the program. The ways students are observed, assessed and approached by both the computer and the instructor are also important factors when determining the appropriate interactivity level for a specific program. In general, the lower the interactivity level, the higher the need for establishing interactivity outside the computer environment. Additionally, the higher the interactivity level, the better chances for learning to occur. A few examples:

• A combination of Do / Be method and Resulting feedback produces a high interactivity level.

• A combination of Browse method and Analyzing feedback produces a medium interactivity level.

• A combination of Browse method and Informing feedback produces a low interactivity level.

Notice that courseware programs of any interactivity are most powerful when they are integrated into the class curriculum. Furthermore, highly interactive courseware programs allow instructors to employ follow up activities in class to analyze the topic in greater depth, to discuss the material with more detail, and to reach other related issues. When using courseware of low interactivity level, instructors need to employ the interactivity outside the computer environment using follow up activities in class and at home.

Summary:

Developing effective educational courseware programs requires more than just using the operational capabilities of the computer. Applying the following three instructional design principles can help ensure that learning has indeed occurred:

1. Define and implement learning strategies to function as information processors that would help students understand, retain and apply the newly learned material.
2. Provide individualized feedback for typical mistakes that students make while learning the new material.
3. Determine media combinations and appropriate interactivity level to fit the target audience and the selected learning strategies.

Online Journal of Distance Learning Administration, Volume I, Number IV, Winter1998
State University of West Georgia, Distance Education

Back to Journal of Distance Learning Administration Contents