The IDXelerator™: Learning-centered Instructional Design

M. David Merrill[1] and Bennet M. Thompson
Department of Instructional Technology, Utah State University

Key words: Instructional design, computer-based instruction, authoring tools

1. INTRODUCTION

In this paper we describe the IDXelerator[2]. This is a learning-oriented instructional development tool (Merrill, 1997a). A learning-oriented development tool is one that includes built-in instructional strategies based on scientifically verified principles of instruction (Gagné, 1985, Merrill et. al., 1996, Merrill, 1997b). Each of these built-in strategies is a complete set of all of the interactions required for the student to acquire a specific kind of knowledge or skill. This system contains a library of preprogrammed instructional strategies that have been carefully designed to include the presentation, practice, learner guidance, and knowledge structure appropriate for achieving a particular learning goal. The user selects a goal and the appropriate instructional strategy. The authoring system then prompts the user to provide the multimedia resources necessary to implement the entire instructional strategy. The system automatically generates the instructional strategies, including practice, learner guidance, and knowledge structure. No programming is necessary: The instructional strategy is built-in and has been previously programmed.

The advantage of such a learning-oriented system is that novice instructional designers and subject matter experts are much more likely to develop effective instruction than is likely with other instructional design tools that require considerably more instructional design expertise. A user can learn to link multimedia resources into this system in a few hours instead of days or weeks. The 30 to 60 percent programming effort required by authoring systems is reduced to one or two percent of the total effort. The design effort is also reduced since the user is not required to design every interaction but merely to select appropriate strategies. Since maintenance merely requires replacing a multimedia resource it can be accomplished in a matter of a few minutes instead of days or weeks. Learning-oriented tools such as IDXelerator™ enable subject matter experts, with only a minimum of instructional design training, to develop quality instruction that will really teach.

Learning-oriented instructional development tools such as IDXelerator™ do have a few limitations. First, these tools are not *theory-neutral*. If the user disagrees with the instructional design theory built-into the system, he or she will not be comfortable with the system. Therefore, the instructional strategies built-into IDXelerator™ have been carefully constructed to implement the best that is known about scientific instructional strategies. (Some of these strategies have been briefly outlined in Merrill, 1997b).

The IDXelerator™ is also limited by the set of instructional strategies included in its library. There are a limited number of classes of effective instructional strategies, nevertheless, there is an infinite number of ways to implement the principles required for a given type of instructional outcome. An authoring system has considerably more flexibility for building a variety of instructional strategies. Therefore, the version of IDXelerator™ described here is a *plug-in* to Asymetrix ToolBook™. When the built-in strategies of the system are appropriate the advantages listed above are available. When a given instructional goal requires some other form of interaction the user can use ToolBook™ to program this strategy. In this way the user has the best of both worlds.

2. THE STUDENT[3] VIEW OF IDXELERATOR™

IDXelerator™ is designed to run within Multimedia ToolBook™[4] and requires the ToolBook runtime system to deliver the instruction to the student. This runtime system can be distributed free of charge with ToolBook lessons. The system includes the following components: a text module, a slide-show, an information-

---

[3] We refer to the learner as *student* and the author of the material to be learned as *user*.

[4] Current versions run in either ToolBook Instructor version 5.0 or 6.0.

about lesson,   a parts-of lesson, a kinds-of lesson and a how-to lesson, a quiz module, and student registration with performance record.   Each of these components are briefly described.   A student view of the kinds-of lesson is included below (see Figure 1).

2.1 Text module

The **text module** can be linked to any ToolBook object so that when a student clicks on that object the text module is called. The text module, consisting of one or more pages of text, is a view window that overlays the current screen display. It displays approximately 16 lines of text on each page. At the bottom of the text window are 5 navigation buttons: help, find-phrase, close-text, page-up and page-down. The *help* button invokes a context sensitive windows help file which directs the student in the use of the text page. The *find-phrase* button enables the student, by typing in any word or phrase, to immediately jump to the page containing this phrase and highlight the requested phrase.   The *close-text* button returns the student to the ToolBook page from which the text module was called. Location on a page is an important learning cue, therefore, the text module does not scroll but rather contains individual pages which can be configured by the user to facilitate these visual cues.   The *page-up* and *page-down* buttons enable the student to navigate from one page to the next.

The built-in lessons of IDXelerator can be linked to any word or phrase in the text module.   A given phrase can be linked to several different kinds of lessons. The name of the lesson is highlighted in the text and when the student clicks on this highlighted phrase a menu pops containing one or more of the following: learn more about, learn the kinds of, learn the parts of, or learn how to. Clicking on the menu item displays the corresponding built-in lesson as described below.

2.2 Slide show

The slide show can be linked to any ToolBook object so that when a student clicks on that object the slide show is called. The slide show, consisting of one or more graphic images, is a view window that overlays the current screen display. Each graphic image can be accompanied by a text caption, an audio caption, or both. The text caption appears in a scrolling text box beneath the graphic. The audio caption plays when the graphic is shown. The student clicks a next button to see the next slide.

2.3 Information-about lesson

An information lesson is called when the student clicks on its name appearing as a highlighted word in a text module (see above) or by clicking on any ToolBook object on a regular ToolBook page to which the lesson is linked.

The information-about lesson consists of a view window divided into two side-by-side panels. The portrayal for the information appears in the left panel. This

information can be any combination of multimedia: a text display, a graphic with or without a written or audio caption, a video display or animation with or without audio. When the portrayal includes audio or video, control buttons appear beneath the left panel that allow the student to stop, or replay the audio or video material. The right panel contains the written information to be learned. Beneath the right panel are optional buttons linking to more information. This *more information* can be any combination of multimedia information similar in format to the portrayal in the left panel. Additional buttons can also link to any other executable program. When the student has finished with the additional information or executable program they are returned to the information-about display. Beneath the left panel is an *OK* button that returns the student to the text module or ToolBook page from which the lesson was called.

2.4 Quiz module

The quiz module is automatically generated by IDXelelerator. This module provides either a multiple choice or short answer quiz for each of the information-about items selected by the user.   The multiple choice version displays the descriptive information (right panel information) followed by 4 alternative answers. The alternatives include the name of the information described and a random selection of the names of 3 other information items from the ToolBook course under consideration.   The student clicks on the correct answer and is given right/wrong feedback.   The short answer version also displays the descriptive information (right panel information) followed by an answer box in which the student types the name corresponding to the information. The quiz has provision for either exact match or key word matching to the name.

The quiz module randomly orders the information items each time it is requested. In the multiple- choice version the alternatives are also randomly ordered each time an item is displayed. The quiz module uses sampling with replacement meaning that when a student misses an item it is put back into the item pool and tested again later in the quiz. Items are replaced until the quiz is mastered. The bottom of the view window includes a *Cancel* button that allows the student to abort the quiz before finishing, an *OK* button used by the student to indicate that their answer is complete and should be evaluated, and a display showing the item number and the number of items in the quiz (e.g. 3 of 10).

The student record system records date/time the student began the quiz, the number of tries required to get all of the quiz items correct, and the date/time the student finished or aborted the quiz.

2.5 Parts-of lesson

A Parts-of lesson is called when the student clicks on its name appearing as a highlighted word in a text module (see above) or by clicking on any ToolBook object on a regular ToolBook page to which the lesson is linked.

The parts-of lesson consists of a view window divided into six parts. The main display occupies about ¾ of the viewer in a panel to the left. This panel contains a graphic on which the parts have been identified. The student explores this display by moving the cursor over the graphic. When the cursor passes over an identified part it is highlighted and its name appears in a text field below the primary display panel. The right side of the view window contains three sections. The top section contains three buttons: *naming quiz, locating quiz,* and *cancel quiz.* The center section contains the following directions during the explore phase: "Explore the graphic. Left-click an image for a description, right-click for a demonstration. After exploring the graphic select a practice mode." The bottom third of the right hand section is used for the naming and locating quiz. At the conclusion of the executable program the student is returned to the parts-of lesson. The bottom of the right section contains an *OK* button. Pressing the *OK* button returns the student to the ToolBook page or text module from which the lesson was called.

The naming quiz highlights a part in the graphic display and displays the names of the parts in the lower section of the right panel. The center right section directs the student to click on the name that corresponds to the part. The student is given right/wrong feedback and the next part is highlighted. This is repeated until the student has correctly named each of the parts.

 The locating quiz displays a name in the lower section of the right panel. The center right section directs the student to click on the location of the part on the graphic display. The student is given right/wrong feedback and the next name is presented. This is repeated until the student has correctly located each of the parts.

The quizzes use sampling with replacement so a missed item is put back into the pool for representation to the student. The record system records quiz start and end times and the number of tries required to name and/or locate all of the parts.

2.6 Kinds-of lesson

A kinds-of lesson is called when the student clicks on its name appearing as a highlighted word in a text module (see above) or by clicking on any ToolBook object on a regular ToolBook page to which the lesson is linked.

The kinds-of lesson consists of a view window divided into five panels. The upper left panel (about ¼ the display) consists of a portrayal for a reference example (*Bitmap File Format* in Figure 1). This portrayal can be any combination of multimedia objects: a text display, a graphic with or without a text or audio caption, or video with or without sound. Audio and video are accompanied by appropriate stop/replay controls. The name of the concept being taught appears above the portrayal panel (*Example of: Bitmap File Format*). The right hand panel (about ¼ of the display) contains a list of the essential or key characteristics of the concept being taught. The lower left ¼ of the display contains two panels: the upper contains a list of examples of the concept and the lower panel contains a list

of non-examples of the concept. When the student clicks on an example name the system displays a multimedia portrayal of the example using any combination of media as described for the reference example. A similar display is presented when the student clicks on the name of a non-example. The example or non-example display can be dragged about the screen to allow the student to compare the example or non-example with the reference example or the essential characteristics. The system records the presentation start and stop times.

The lower left panel of the display contains two buttons: *OK* and *Take Quiz.*
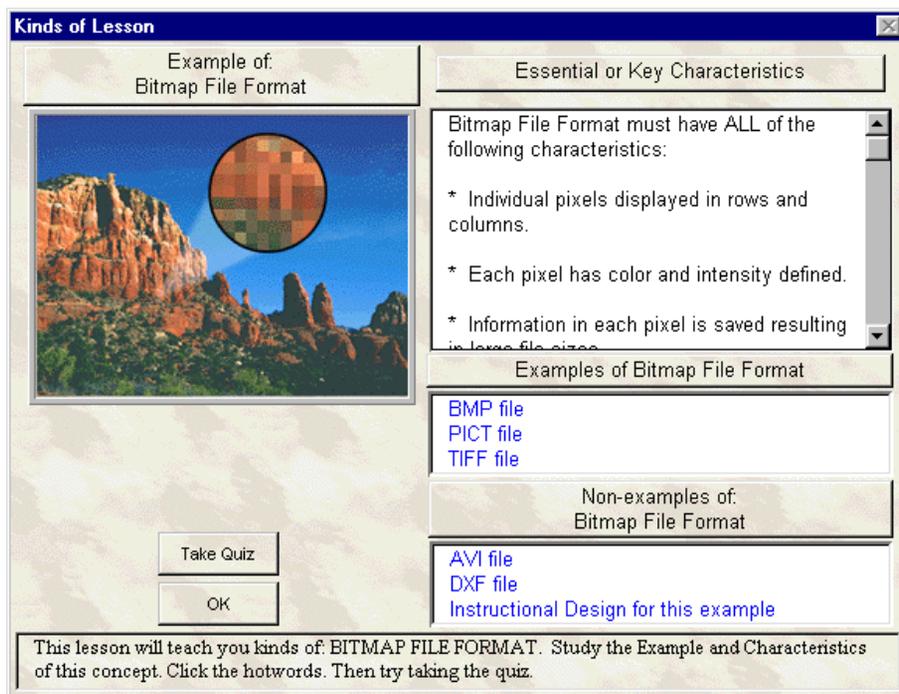
Figure 1 Student view of Kinds-of lesson

For the kinds-of quiz the system presents examples and non-examples using the same format as above. The student is directed to click on a *TRUE* button if the display is an example of the concept being taught or the *FALSE* button if the display is a non-example of the concept being taught. The quiz uses sampling with replacement and requires the student to get all of the instances correct. The quiz also includes a *Cancel* button allowing the student to abort the quiz. The system records quiz start and stop/abort and the number of tries required to get all of the instances correct.

A narrow text box across the lower part of the display provides directions to the student as the lesson/quiz progresses.

2.7 How-to lesson

A How-to lesson is called when the student clicks on its name appearing as a highlighted word in a text module (see above) or by clicking on any ToolBook object on a regular ToolBook page to which the lesson is linked.

The how-to lesson consists of a view window divided into two panels. The left panel contains a list of the steps in the procedure being taught. The right hand panel contains a portrayal of the step highlighted at the left. The portrayal can be any combination of multimedia objects including text, graphic with or without text or audio caption, or video with or without sound. Audio and video portrayals are accompanies by appropriate stop/replay controls. The bottom of the display contains three buttons: *Consequence*, *OK*, and *QUIZ*. The C*onsequence* button is optional and is used to show what the consequence of a given step might be. It calls up a multimedia display similar to the portrayal described above. The *QUIZ* button is used to start the how-to quiz. The *OK* button returns the text module page or ToolBook page from which the lesson was called. The system records start and stop times for the lesson presentation.

The how-to quiz randomly orders the list of steps in the left panel. The student is directed to drag-and-drop the names of the steps until they are in the correct order. The demonstration of each step is available in the right panel as with the presentation. A *Cancel* button allows the student to abort the quiz. An *Evaluate* button caused the system to compare the student's order of steps with the correct order. If a step is not in the correct order the student is given feedback to this effect and asked to try again. The quiz is finished when the student has arranged all of the steps in the correct order. The system records the start and stop/abort time and the number of tries required to get all of the steps in the correct order.

2.8 Student Registration and records

When a student signs on to the run time version of the ToolBook course they are asked to register. A registration form requests the student's name, ID number, course/period and instructor's name. If the student has previously registered the student's record is located and his new course start time recorded. If the student has not previously registered a new student record is created. The registration form also contains an *instructor login* button that allows the instructor, after providing a pass word, to review all of the student records.

3. THE AUTHOR VIEW OF IDXELERATOR™

IDXelerator adds an *IDX* menu item to the ToolBook authoring page. This menu contains the following items: *Edit Text Module, Launch Text Module, Link Text Module (*divider*), Edit Slide Show, Launch Slide Show, Link Slide Show (*divider*), Edit Lesson, Launch Lesson, Link Lesson (*divider*), Edit Info Quiz,*

*Launch Info Quiz, Link Info Quiz (*divider*), About IDXelerator.*   Each of these functions is described in the following paragraphs.

3.1 Front end analysis.

Like all instructional development creating a course using IDXelerator requires an analysis phase and an instructional design phase prior to beginning development. In the analysis phase the instructional design must first determine audience requirements, goals of instruction, need for the instruction, etc. In the design phase the designer must decide what kind of lesson is required for each goal and whether the lessons built-in to IDXelerator are sufficient for the goals of the instruction. IDXelerator does not yet contain a wizard to help decide what kind of lesson is required for each goal. The designer must then decide what multimedia objects are required by each of the built-in lessons of IDXelerator.

3.2 Development phase.

The development phase requires three activities: The user must first build a course interface using ToolBook Instructor. Such an interface consists of menus, course structure, overview materials, etc. The built-in functions and lessons of IDXelerator are called by linking its components to ToolBook objects in this interface.

Second, the user must obtain or prepare the multimedia objects required to implement the built-in strategies of IDXelerator.   The folder containing the ToolBook Course must contain folders with the following names: *text, graphics, audio, video*. The corresponding multimedia objects are placed in these files.

Third, the user must link multimedia objects into appropriate slots of template forms corresponding to the various modules or lessons of the system. At this phase in the development process authoring IDXelerator components is relatively easy. The only computer skill needed is the ability to use the Windows™ file manager.

Clicking on one of the editors from the IDX menu calls up a list of all of the components (text modules, slide-shows, info lessons, parts of lessons, kinds of lessons, how to lessons, quiz modules) of this type already created for this ToolBook course. A given course can have as many of each type of component as required. Clicking on the name of a component on the list provides the user with the following options: *Add a new* <component>, *Edit* <component> <name>, *Delete* <component> <name>, *Select* <component> <name> .   *<Component>* gives the name of the IDX component: Text Module, Slide Show, Info Lesson, Parts of Lesson, Kinds of Lesson, How to Lesson, Quiz Module.   *<Name>* provides the specific name of the component selected.

For example suppose we have a text module called *"The Four Stroke Engine"*. Selecting the IXD menu item *Edit Text Module* would display a list of all the text modules in the course. Among the list would appear the name *"The Four Stroke*

Engine".   Selecting this item would pop-up a menu consisting of the following items: Add a new text module,   Edit text module "The Four Stroke Engine", Delete text module "The Four Stroke Engine",   Select text module "The Four Stroke Engine." Selecting the item Edit text module "The Four Stroke Engine" opens the text module editor.

Each of the IDX editors works the same.   They consist of a series of slots labeled with the information required. If the slot requires only a text name a dialog box appears into which the user types the name. It the slot requires a resource file clicking on the slot calls up a menu consisting of the following items: *Select video resource file, Select graphics resource file, Select text resource file, Edit resource file, Deselect resource file pointers*. If the slot only supports text then the *Select graphics* and *Select video* items do not appear, etc.   Clicking on a *Select graphics* or *Select video* or *Select text* item causes the Windows file manager to list all the resources in the appropriate multimedia file (text, graphics, audio, video). The user merely clicks on the name of the file. The file is then linked to the slot in the authoring template and the name of the file appears in the slot in the IDX editor (See Figure 2).
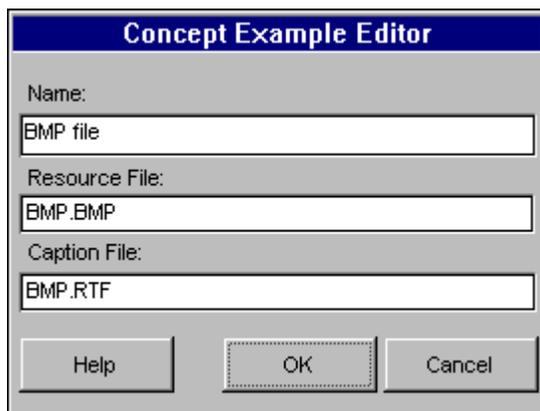
Figure 2 Typical IDX editor for linking multimedia resources.

Selecting the *Edit resource file* item on the pop-up menu opens the appropriate text editor, audio editor or video editor. The user can then view or modify the multimedia resource in the context of authoring.

Selecting the *Deselect resource file pointers* item on the pop-up menu unlinks the resource from the slot in the authoring dialog.

Each IDX editor also contains the following buttons: *Help*, *OK*, and *Cancel*. *Help* provides context sensitive help for authoring this editor, *OK* accepts the links made in the editor. *Cancel* discards the links made in the editor.

Selecting a component enables the *Link* <component> and *Launch* <component> items on the IDX menu. The *Launch* command allows the user to see the student view of the selected component in authoring mode. The *Link* command allows the user to link the component to a selected ToolBook object on the current ToolBook page. When a student clicks on this object in runtime the linked IDX component will be launched. For example, after having selected the item "The Four Stroke Engine" the Launch text module … and Link text module … items would pop-up the name "The Four Stroke Engine" when they are selected.

The *Link* command assigns Toolbook script to the selected object. This script uses a *to handle buttonclick* command structure to initialize lessons. Users can edit this script to better fit their programming strategy. For example, they can edit an object's script to initialize the lesson on a *doubleclick.* This allows the author to take full advantage of Toolbook functionality.

3.3 Text Module Editor

The text module editor contains the following slots: Text Module Name, Text File, Info Lessons: (a list), Kinds of Lessons: (a list), Parts of Lessons: (a list) and How to Lessons (a list). Clicking in the lesson lists pops-up the following menu items: *Select* <lesson type> *lesson*, and *Deselect* <lesson type>: <lesson name>. The *select* item displays the list of all lessons of the type under consideration. Clicking on a lesson name adds it to the list. *Deselect* cuts the lesson from the list but does not delete the lesson from the course.

3.4 Slide Show Editor

The slide show editor contains the following slots: Overview Slide Presentation: (name of slide show), a left hand panel listing the name of each slide, a right hand panel showing the file name of the slide graphic and slide audio (audio file). Clicking in the slide list panel pops up the following menu: Build new slide, Edit Slide: <slide name>, Move slide up: <slide name>, Move slide down <slide name>, Deselect slide: <slide name>.

Build new slide pops up a slide show editor consisting of three slots: Slide Caption: (text), Slide Graphics File: (link to graphic file), Slide Audio File: (link to audio file).

3.5 Info Lesson Editor

The Info Lesson Editor has two tabs: Info Lesson Data and Info Lesson Extras. The Info Lesson Data tab contains the following slots: Info Lesson Name: (text), Info Keywords: (text), Info Representation (graphic or video file), and Info Description (text file).

The Info Lesson Extras tab contains 4 panels. The top left panel is a list of Additional Information names that appear on the student view of the Info Lesson.

The right top panel shows the multimedia files linked to these hot word names. Clicking in the Additional Information panel pops up an Additional Info Editor dialog with the following slots: Hotword text (text), Resource File (graphics, video, or audio file), and Caption File (text or video). In the student view clicking on a hotword displays the resource file and caption to the student.

The bottom left panel is a list of names that Link to Other programs. The lower right panel shows the execute files associated with these names. Clicking in the *Other Programs* panel pops-up a Learning Applications Editor with two slots: Program Introduction (text) and Program file (name of executable file).   When the student clicks on one of these names the associated program will execute.

Kinds of Lesson Editor

| Concept Lesson Data | Examples/Non-Examples | Concept Quiz Items |

Concept Name: Bitmap File Format

Concept a Kind of: digital image file

Reference Example: DIGITAL.BMP,

Key Characteristics:

```
*  Individual pixels displayed in rows and columns.
*  Each pixel has color and intensity defined.
*  Information in each pixel is saved resulting in large
file sizes.
*  Images are still graphics with no motion or animation.

NOTE: THE ELECTRONIC TRAINER ONLY ACCEPTS
FILES IN BMP FORMAT.
```

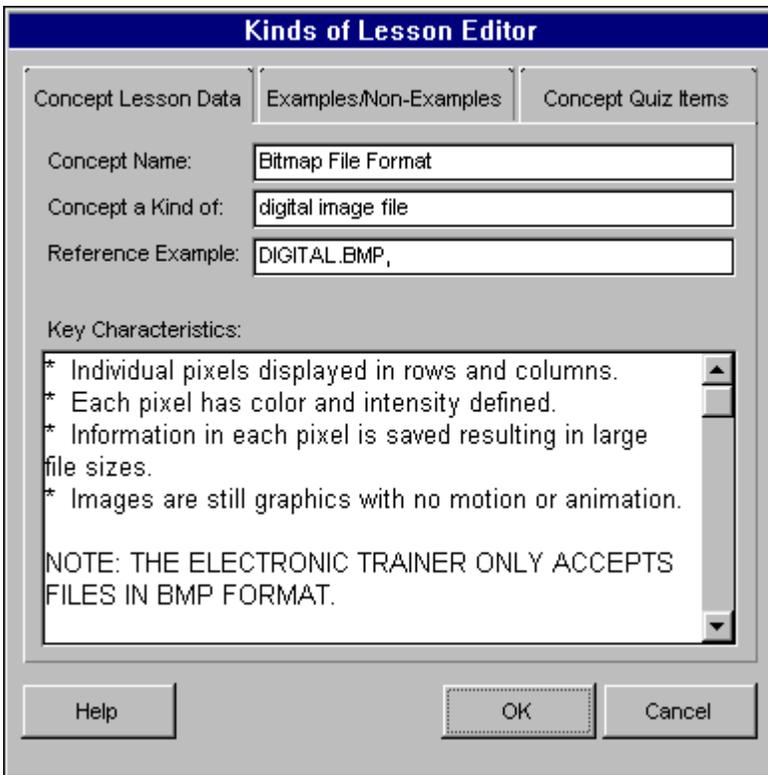| Help | | OK | Cancel |

Figure 3 Concept lesson authoring dialog.

3.6 Quiz module Editor

The Quiz module editor provides a way to practice/text the information presented by the Info lessons. The Info Quiz Editor contains a Quiz name slot (text) and a Quiz Item list panel. The Quiz Items are the names of Info lessons. Clicking in the *Quiz Items panel* pops up a menu with two items: Select Info Quiz

items, Deselect Info Quiz <name>. Selecting Select Info Quiz items presents a list of all the Info Lesson in the course. Clicking on the name of the Info Lesson adds it to the quiz.

The Info Quiz Editor also includes two buttons: *Multiple Choice* and *Short Answer*. This determines the format of the Quiz items. Either or both options can be selected.
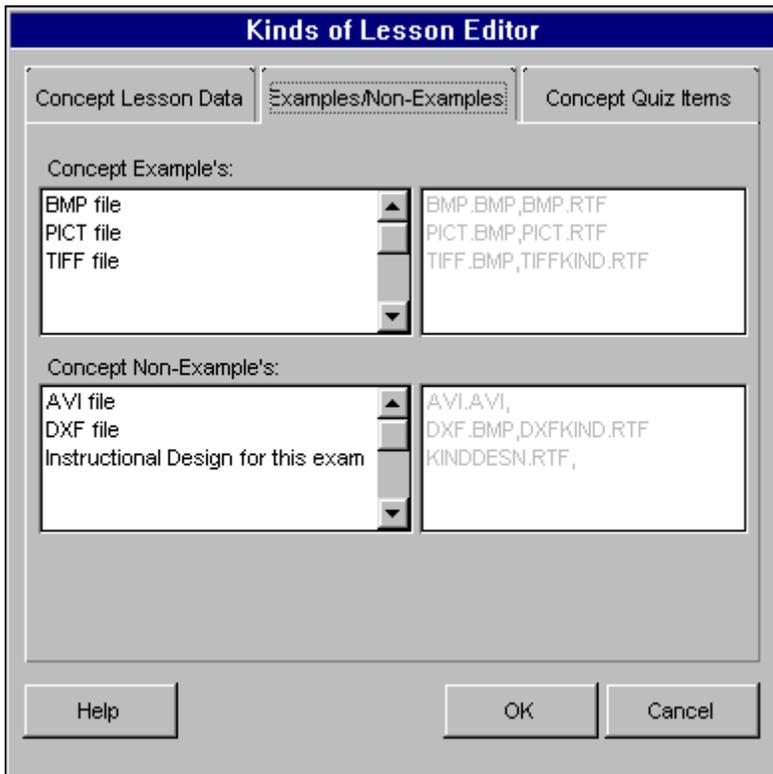
Figure 4 Examples/Non-Examples dialog for kinds-of lessons.

3.7 Kinds-of lesson Editor

The Kinds of lesson editor has three tabs: Concept Lesson Data, Examples/Non-Examples, and Concept Quiz Items (See Figure 3). The *Concept Lesson Data* tab contains the following slots: Concept name (text), Concept a Kind of (text), Reference Example (link to text, graphic, audio, or video file and text or audio caption file), Key Characteristics (text).   A portion of the *Help* file for the Kinds-of authoring dialog is illustrated in Figures 5 and 6. This is context sensitive imperative help that directs the user in the next steps of the authoring process.

The *Examples/Non-Examples* tab contains four panels (See Figure 4).   The upper left is a list of Concept Examples names. The upper right panel lists the linked text, graphic, audio, or video file and the text or audio caption file associated with the example name. The lower left is a list of the Concept Non-Examples. The lower right panel lists the linked text, graphic, audio, or video file and the text or audio caption file associated with the non-example name.

Figure 5 Help screen for kinds-of lesson editor.
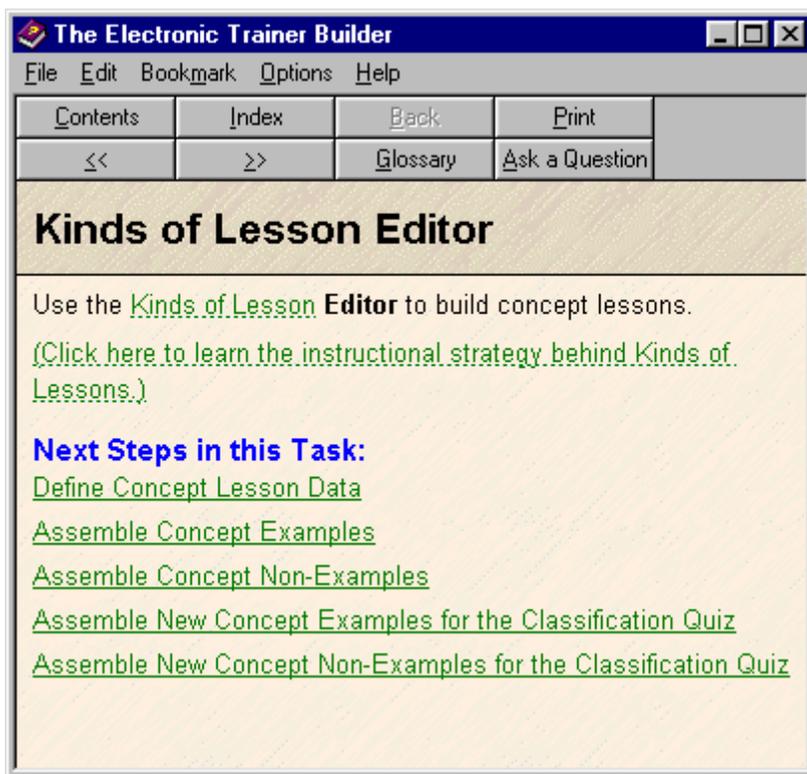
The *Concept Quiz Items* tab also contains four panels. The upper panels listing the Concept Examples and associated multimedia files, the lower panels listing the Concept Non-Examples and associated multimedia files. In the quiz to the student these items are presented to the student in random order.

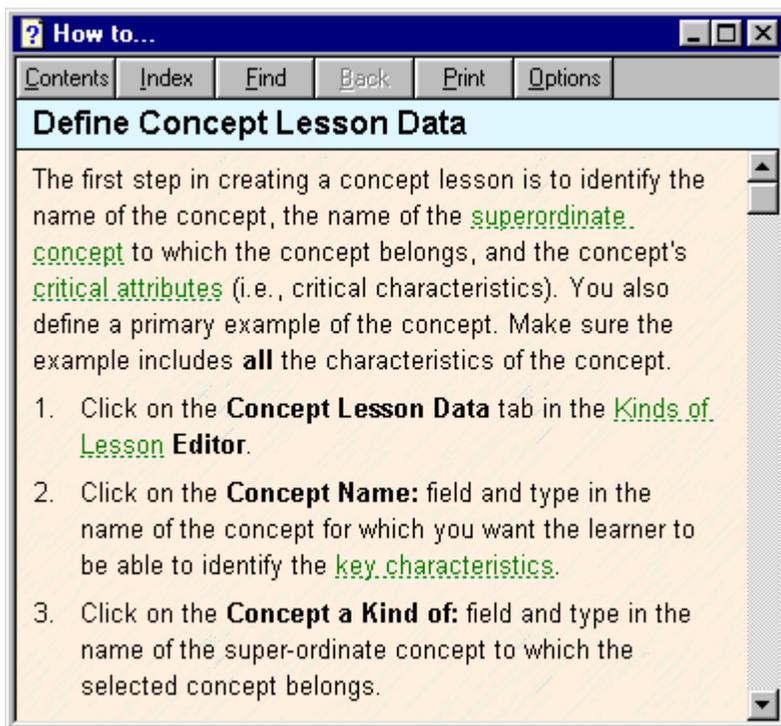Linking files into these slots is as described for other editors.

```
┌─────────────────────────────────────────────────────────────┐
│ ⍰ How to...                                        _ □ ✕     │
├──────────┬────────┬────────┬────────┬────────┬──────────┬────┤
│ Contents │ Index  │ Find   │ Back   │ Print  │ Options  │    │
├──────────┴────────┴────────┴────────┴────────┴──────────┴────┤
│ Define Concept Lesson Data                                   │
├──────────────────────────────────────────────────────────┬──┤
│ The first step in creating a concept lesson is to identify│▲ │
│ the name of the concept, the name of the superordinate     │  │
│ concept to which the concept belongs, and the concept's    │  │
│ critical attributes (i.e., critical characteristics). You  │  │
│ also define a primary example of the concept. Make sure    │  │
│ the example includes all the characteristics of the        │  │
│ concept.                                                   │  │
│                                                            │  │
│ 1.  Click on the Concept Lesson Data tab in the Kinds of   │  │
│     Lesson Editor.                                         │  │
│                                                            │  │
│ 2.  Click on the Concept Name: field and type in the       │  │
│     name of the concept for which you want the learner to  │  │
│     be able to identify the key characteristics.           │  │
│                                                            │  │
│ 3.  Click on the Concept a Kind of: field and type in the  │  │
│     name of the super-ordinate concept to which the        │  │
│     selected concept belongs.                              │▼ │
└──────────────────────────────────────────────────────────┴──┘
```

Figure 6 Help screen for *Define Concept Lesson Data.*

3.8 Parts of Lesson Editor

The Parts of lesson editor consists of the following slots: Object's Name (text), Objects Image (graphic file), three list panels Object's Component Parts.   The name of each part appears in the left panel, the multiple media resource files associated with each part is listed in the center panel, the location of the part on the screen is listed in the right panel. Each part can have two pieces of information a description (text file) and a resource (graphic, video file) with an audio or text caption file. Clicking in the left panel pops-up a menu with the following items: Add New Component, Edit Component <name>, Position Component <name>, and Delete Component <name>.   Linking files is as previously described. Positioning a component consists of outlining the location of the part on the Object image.

3.9 How to Lesson Editor

The How to lesson editor consists of the following slots: Lesson Name (text), and three panels. The left panel is a list of the Events in the lesson. The middle panel lists the multimedia files which demonstrate the event (video, graphic, text) with audio or text caption. The right panel lists the multimedia files that show the

consequence of the event (video, graphic, text) with audio or text caption. Authoring is the same as previously described. Clicking of the left panel pops up the following menu: Add new event, Edit event <name>, Move up event <name>, Move down event <name>, Delete event <name>.   The quiz for the How to lesson consists of ordering the events into the sequence shown in the left panel.

4. SUMMARY

IDXelerator™ is an authoring system implementing the notion of learning-centered instruction. Instructional design is built-into the system via built-in lessons of different types. It is based on the assumption that different instructional goals required different types of instructional presentation and practice.   The system includes four built-in lessons each complete with presentation, practice, and learner guidance: information about, parts of, kinds of, and how to. In addition the system includes a text module and slide show function. IDXelerator™ is a ToolBook™ plug-in adding an IDX item to the authoring menu.   Any IDX component can be linked to any ToolBook object.   IDXelerator™ increases authoring efficiency by at least 50% and simultaneously increases the effectiveness of the instruction by using scientifically verified instructional strategies consistent with instructional outcomes.

5. REFERENCES

Merrill, M. D. (1997a). Learning-oriented instructional development tools. *Performance Improvement*, 36 (12), 51-55.

Merrill, M. D. (1997b).   Instructional strategies that teach. *CBT Solutions*, November/December issue, pages 1, 4, 8, 10-11.

Merrill, M. D., Drake, L., Lacy, Mark J., Pratt, J & ID$_2$ Research Group (1996). Reclaiming Instructional Design. *Educational Technology*, 36(5), 5-7.

Gagné , R. M. (1985) *The Conditions of Learning and Theory of Instruction*. New York: Holt, Rinehart, and Winston.