Multimedia

By:
cao ying

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cao ying

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C O N N E X I O N S

Rice University, Houston, Texas

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Introduction[1]

Knowledge Objectives

1. Define multimedia and describe five instructional examples.

2. Describe instructional applications that are especially appropriate for multimedia kits.

3. Define hypermedia and describe three instructional applications.

4. Describe an instructional situation in which you could use hypermedia materials. Include the setting, topic, audience, objectives, content of interactive video materials, and rationale for using this media format.

5. Diagram and briefly describe the components of an interactive media system.

6. Define virtual reality and describe how it might be used in education.

7. Describe instructional applications that are especially appropriate for virtual reality.

8. Describe an instructional situation in which you might use an expert system. Include the setting, topic, audience, objectives, content of interactive video materials, and rationale for using this media format.

Professional Vocabulary

Multimedia, Multi-media kits, hypertext, browse, link, author, script, button, navigate, interactive media, virtual reality (VR), expert system

Perface

Chapters throughout this book focus on various individual audio media, visual media, and computers. This chapter discusses combinations of these media. The generic term multimedia refers to the sequential or simultaneous use of a variety of media formats in a given presentation or self-study program.

Multimedia systems may consist of traditional media in combination or they may incorporate the computer as a display device for text, pictures, graphics, sound, and video. The term multimedia goes back to the 1950s and describes early attempts to combine various still and motion media for heightened educational effect. Multimedia involves more than simply integrating these formats into a structured program in which each element complements the others so that the whole is greater than the sum of the parts. Today examples of multimedia in education and training include slides with synchronized audiotapes, videotapes, CD-ROMs, DVD, the World Wide Web, and virtual reality.

The goal of multimedia in education and training is to immerse the learner in a multisensory experience to promote learning. One can read about walking on a beach. Someone describing the experience orally along with the recorded sounds of the waves enhances the "experience". The addition of motion video lets one "see" the sights. Running one's hands or feet through a box of sand and handing sea shells lets the "experience" become more real. Multimedia makes one's experience as realistic as possible without actually being there.

In the past the predominant mode of providing instructional experiences was the written and spoken word through textbooks and the lecture. As shown in Dale's Cone of Experience, "verbal symbols" are the most abstract. A newer form of media, virtual reality, is near the bottom (more concrete) of Dale's Cone. Virtual

[1] This content is available online at <http://cnx.org/content/m34299/1.1/>.

reality is very effective and efficient in recreating reality and approaches “direct purposeful experiences”—the most tangible mode of learning.

Instructional designers understand that individual learners respond differently to various information sources and instructional methods, so chances of reaching an individual are increased when a variety of media are used. Multimedia also attempts to simulate more closely the conditions of real-world learning, a world of multisensory, all-at-once experiences.

Multimedia addresses different learning styles. Auditory learners, and tactile learners all benefit from multimedia's varied presentation forms. The redundancy or print, sound, visuals, and motion media allows learners to choose for themselves the most meaningful sensory mode. When you, the instructor, have a clear sense of objectives and the necessary student practice, you can decide what media will best facilitate the learning and how best to deliver it.

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This chapter will explore the following types of multimedia:

Multimedia kits—a collection of materials involving more than one type of medium and organized around a single topic

Hypermedia—media that allow the composition and display of non-sequential materials

Interactive media—media that require learners to practice skills and receive feedback

Virtual reality—media in which users experience multisensory immersions and interact with phenomena as they would in the physical world

Expert systems—software package that teach learners how to solve a complex problem by applying the collective wisdom of experts in a given field

Chapter 2

Multimedia Kits[1]

A multimedia kit is a collection of teaching/learning materials involving more than one type of medium and organized around a single topic. Kits may include CD-ROMs, slides, audiotapes, videotapes, still pictures, study prints, overhead transparencies, maps, worksheets, charts, graphs, booklets, real objects, and models.

Some multimedia kits are designed for the teacher to use in classroom presentations. Others are designed for use by individual students or by small groups.

Commercial multimedia kits are available for a variety of educational subjects. These learning kits may include videotapes, audiocassettes, floor games, board games, posters, full-color photographs, activity cards, murals, wall charts, geometric shapes, flash cards, laboratory materials, for science experiments, and even puppets to act out stories. They also normally include student worksheets and a teacher's manual.

Teachers or media specialists can also prepare multimedia kits. The main purpose of a kit is to give learners a chance at firsthand learning —to touch, to observe, to experiment, to wonder, to decide.

Availability and cost of materials are obviously important considerations. Will there be one kit for all students to share, or can the kit be duplicated for all? If so, where will students find the necessary equipment? Can the kit be used in a variety of instructional situations?

Advantages

Internet. Multimedia kits arouse interest because they are multisensory. Everyone likes to touch and manipulate real objects—to inspect unusual specimens up close.

Cooperation. Kits can be an ideal mechanism for stimulating small-group project work. Cooperative learning activities can revolve around experiments, problem solving, role playing, or other types of hands-on practice.

Logistics. Kits have an obvious logistics advantage. Being packaged, they can be transported and used outside the classroom, such as in the media center or at home.

Limitations

Expense. Learning with multimedia kits can be more expensive than with other, more conventional methods.

Time consuming. It can be time consuming to produce and maintain the materials.

Relpacement. Lost components can make the kit frustrating to use.

Integration

Multimedia kits are particularly well suited to content for which discovery learning is preferred. You can pose questions to guide learners' exploration and arrival at conclusions. Science topics are well suited to this approach. For example, a kit on magnetism might include several types of magnets, iron filings, and metal objects that may or may not be attracted to magnets. In mathematics, a kit on measurement might include a folding meter stick and directions for measuring various objects and dimensions around the home or in school.

[1]This content is available online at <http://cnx.org/content/m34288/1.2/>.

Chapter 3

Hypermedia[1]

Hypermedia

The term hypertext was coined by Nelson in 1974 to describe "non-sequential documents" composed of text, audio, and visual information stored in a computer, with the computer being used to link and annotate related chunks of information (nodes) into larger networks, or webs(Nelson, 1974a & b). The goal of hypertext is to immerse users in a richly textured information environment, one in which words, sounds, and still and motion images can be connected in diverse ways. Enthusiasts feel that the characteristics of hypertext parallel the associative properties of the mind, thereby making the construction of one's own web a creative educational activity.

Hypermedia refers to computer software that uses elements of text, graphics, video, and audio connected in such a way that the user can easily move within the information. Users choose the pathway that is unique to their own style of thinking and processing information. According to its very nature, it provides a learning environment that is interactive and exploratory.

Hypermedia is based on cognitive theories of how people structure knowledge and how they learn. It is designed to resemble the way people organize information with concepts and their relationships, or links, are associations between ideas—for example, when thinking about bicycles, one creates a link between ideas about transportation and recreation. With hypermedia, one can link asynchronous data sources directly to compose and display non-sequential information that may include text, audio and visual information. There is no continuous flow of text, as in a textbook or novel. Rather, the information is broken into small units that the author or user associates in a variety of ways. Using the bicycle example, the learner can connect the word "bicycle" with a photo of a girl riding a bicycle in a field and a video clip of a Hong Kong boy carrying a duck to market on the back of a bicycle.

The intent of hypermedia is to enable the user to move about within a particular set of information without necessarily using a predetermined structure or sequence. The chunks of information are analogous to notes on a collection of cards. Each card contains a bit of information. Subsequent cards or sets of cards (often refers to as stacks) may contain extensions of the information from the initial card or other relevant or related information. Hypermedia programs are usually set up so that each computer screen display is equivalent to what is displayed on one of the cards.

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Computer hypermedia systems can be used for several different purpose:

Browsing. Users browse, or navigate through the information by choosing routes that are of interest. You can explore features in detail as it suits your personal learning style.

Linking. Users can create their own special connections, or links, within the information.

Authoring. Users can author, or create, their own unique collections of information, adding or linking text, graphics, and audio as they wish. They can use this creation for their own individual use, to share with others, or to prepare a report or presentation.

[1]This content is available online at <http://cnx.org/content/m34289/1.2/>.

Hypermedia materials can be created easily. The user can write a script using a special scripting language that is more like spoken language than earlier programming codes (such as those used for BASIC and Pascal). Any object can become "hyper" through scripting. For example, a word can become "hot", thus allowing the user to connect to a glossary or to other concepts associated with that particular term. Graphics and buttons can also b scripted as links to other information. The user, with the aid of a mouse, points to a word or a button and clicks the mouse. A button is an icon that might be a picture or graphic or might look like a button one might press on any electric device. The button is used to move around in the hypermedia environment. In a hypermedia environment, then, you activate the link and make the connection between pieces of information. The linking interface lets you navigate, or move about, more quickly and precisely within a hypermedia environment. The interactive nature of hypermedia is the essence of its advantages. Hypermedia engages learners to make choices about moving within the material in meaningful ways, thus fulfilling the requirement of learner participation (the R of the ASSUTRE model).

Advantages

Engrossing. The opportunity for deep involvement can capture and hold student interest.

Multisensory. The incorporation of sounds and images along with text expands the channels to the mind.

Connections. By using "hot buttons" students can connect ideas from different media sources, for example, connecting the sound of a foghorn with the word "lighthouse".

Individualized. Web structure allows users to navigate through the information according to their interests and to build their own unique mental structures based on their exploration.

Teacher and student creation. Software allows teachers and students to easily create their own hypermedia files; student projects can become opportunities for collaborative work.

Limitations

Getting lost. Users can get confused, or "lost in cyberspace," when using hypermedia programs because of limited clues as to where they are in the material.

Lack of structure. Students whose learning style requires more structured guidance may become frustrated. Students ay also make poor decisions about how much information they need to explore.

Non-interactive. Programs can be simply one-way presentations of information with no specific opportunities for interactive practice with feedback.

Complex. More advanced programs may be difficult to use, especially for the student production because they require the ability to use a scripting language.

Time consuming. Because they are nonlinear and invite exploration, hypermedia programs tend to require more time for students to reach pre-specified objectives. Because they are more complex than conventional instructional material, hypermedia systems require time for both teachers and students to learn to use.

Integration

Hypermedia can be developed and used on the same computer systems that are commonly found in schools. They are applied in all areas of the curriculum, for any learning goals that are suited to individual or small-group exploration of a body of information. Hypermedia programs are available as off-the-shelf courseware; teachers can create them to fit unique local needs; or students can create them as a way of organizing and synthesizing their research on a topic of interest.

Ready-made hypermedia instructional courseware is available for teachers to use in their classrooms. Many titles have been developed for use in all areas of study. For example, Digestion is designed to be used by secondary science students; with complex and accurate diagrams, students can learn about the process of digestion. This program is available as a complete package; you do not have to do anything to the software. However, you will need to consider how to best introduce the application into the curriculum and what types of follow-up are appropriate.

Connie Courbat, a third-grade teacher, developed HyperStudio stacks to use with her students for their study of the Oregon Trail and the westwards movement. Her academically challenged students used an instructional stack and reported on the information they learned. With her more advanced students, she developed a shell for stacks that her students could use to create their own stacks. These stacks were created to help the rest of the class learn more about the westward movement. All the students had an opportunity to utilize hypermedia in a manner appropriate to their learning levels, and everyone enjoyed their learning experiences.

Teachers can either adapt existing materials or create new materials to fill a need of their own students. When you and your students are creating any multimedia materials, be certain to follow copyright guidelines (see "concerns: Multimedia Materials"). Because hypermedia software—for example, HyperStudio—provides an easy-to-use authoring language, many teachers have learned to successfully develop their own hypermedia materials. One caution: don't think that ability to use the automatically bestows expertise either in instructional design or visual design. These skills are usually developed through special study and lots of practice. Some advice on screen design is provided in "Designing Computer Screens," in Classroom Resources, Section C.

Hypermedia can shift the roles of teacher and learners in the classroom. Because hypermedia materials are so easy to develop, it is feasible for students to create their own programs and thus gain the benefits of creative learning. Given instruction, students can create hypermedia materials that revolve around a particular topic of study. Your role becomes that of resource person for the students. Digital video and audio can be added to hypermedia files with little effort. Most computer systems have the capabilities of adding digitized "video clips" without any additional software or hardware. For example, QuickTime color "movies" can be imported into HyperStudio stacks with ease. In addition, QuickTime movies can be added to other types of files, such as word processing documents.

It is beyond the scope of this chapter to describe in detail the various techniques for developing hypermedia. Resources on hypermedia development are listed in the Suggested Readings at the end of the chapter.

Chapter 4

Interactive Media[1]

Interactive Media

Computer-based interactive media creates a multimedia learning environment that capitalizes on the features of both video and computer-assisted instruction. It is an instructional delivery system in which recorded visuals, sound, and video materials are presented under computer control to viewers who not only see and hear the pictures and sounds but also make active responses, with those responses affecting the pace and sequence of the presentation.

The video portion of interactive media is provided through CD-ROM, DVD, or the Web. Because CD-ROM discs can store many types of digital information, including text, graphics, photographs, animation, and audio, they are popular in school setting, library media centers, and classrooms of all sorts. Anything that can be stored on a computer disk can be stored on a CD-ROM. Multimedia CD-ROM products are commonly found in school library media centers, primarily in the form of encyclopedias or other reference databases .The application of multimedia and hypermedia to core curriculum is increasing with the advent of improved quality of available resources. In higher education there is large-scale experimentation with locally produced multimedia and hypermedia, but such applications have been limited to specific content areas, such as modern languages, communications, and technology studies.

The images can be presented in slow motion, fast motion, or frame-by-frame (as in a slide show). The audio portion may occupy two separate audio channels, making possible two different narrations for each motion sequence.

The interactive aspect of interactive video is provided through computers, which have powerful decision making abilities. Combining computers and video allows the strengths of each to compensate for the limitations of the other to provide a rich educational environment for the learner. Interactive media is a powerful, practical method for individualizing and personalizing instruction.

With the introduction of hypermedia, it has become easier to prepare teacher- developed and student-developed interactive multimedia. Students are discovering an innovative way to activate their learning through simple-to-prepare hypermedia stacks.

The heart of an interactive media system is the computer, which provides the 'intelligence' and interactivity required. The computer can command the system to present audio or video information, wait for the learner's response, and branch to the appropriate point in the instructional program from that response.

The learner communicates with the instructional program by responding to audio, visual, or verbal stimuli displayed on the monitor. Input devices provide the means for these responses. These devices include such items as a keyboard, keypad, light pen, barcode reader, touch-sensitive screen, and mouse.

A monitor displays the picture and emits the sound from the video source. It can also display the output from the computer software, which may have text, graphics, or sound effects. In most systems the computer output can be superimposed over the video image.

[1] This content is available online at <http://cnx.org/content/m34293/1.2/>.

Advantages

Multiple media. Text, audio, graphics, graphics, still pictures, and motion pictures can all be combined in one easy-to-use system.

Learner participation. The R of the ASSURE model is achieved with interactive video materials because they require that learners engage in activities. These materials help to maintain students' attention, and they allow greater participation than does video viewing alone.

Individualization. Individualization is provided for because branching allows instruction on remedial as well as enrichment levels.

Flexibility. The learner may choose what to study from the menu, selecting those areas that seem interesting, that seem most logically to answer a question, or that present the greatest challenge.

Simulations. Interactive video may be used to provide simulation experiences in such areas as medicine, machine operations, and especially interpersonal skills. The development of skills in working with children in a classroom, which otherwise would require role playing or live interactions, can be pros ded as an individual, self-paced simulation exercise.

Limitations

Cost. The most significant limitation to interactive video is the cost, although the prices of ready-made discs and hardware are decreasing.

Production expense. It can be expensive to produce commercial CD-ROM and DVD discs, which may not meet local needs.

Rigidity. Commercial discs cannot be changed once they have been made; therefore materials may become outdated.

Integration

Interactive media systems are valuable for tasks that must be shown rather than simply told. Some instruction cannot be adequately presented by printed materials. If the learner needs to interact with the instruction, interactive media is an appropriate choice.

Interactive media systems are currently being used in a variety of instructional applications, from teaching scientific phenomena to teaching special education students to tell time. The programs can challenge a small group of gifted students or provide remedial instruction for students who might be having difficulty with particular concepts.

Individuals as well as small groups can use interactive media programs. There is a growing trend, particularly in elementary education, toward small-group applications, providing opportunities for students to engage in cooperation and collaborative problem-solving activities.

Interactive media may also be used for large-group instruction. The teacher alone may use the instructional program, with large-screen projection or an LCD projector for presentation to the whole class. The teacher can then move through the material in a sequence that will promote learning-stopping where appropriate for discussion, jumping ahead to new material in a sequence that when necessary. The pause-and-discuss method might work well when reviewing a topic.

Although interactive media is readily available in the schools, it had actually been used in training since the early 1980s by many corporations and the military. The use lf packaged programs originally wad more than twice as common as the use of custom-designed programs. Such areas as medicine, auto mechanics, electronic ignition systems, and communication skills were incorporated into interactive media materials.

Interactive multimedia formats have gained a foothold in corporate training, primarily delivering basic courses across multiple sites. Organizations routinely incorporate multimedia courseware into their training programs; thus the supply of less expensive off-the-shelf materials has increased as demand has risen.

Chapter 5

Virtual Reality[1]

Virtual Reality

Virtual reality (VR) is one of the newest applications lf computer-based technologies. There are actually several levels of virtual reality, from complex, meaning you are completely immersed inside the virtual environment, to augmented, or partially immersed, to desktop level, meaning you are using your computer to look into a virtual "window."

At the complex level, virtual reality is a computer-generated, three-dimensional environment where the user can operate as an active participant. The user wears a special headpiece that contains a three-dimensional liquid crystal video display and headphones. The user participates

within the three-dimensional world by manipulating a joystick or a special data glove worn on one hand. The data glove may be used to point, handle, and move objects and to directs the user's movements within the virtual world. Or the environment can be a chamber or room where the images are projected on the walls, ceiling, and floor. The "CAVE" at the University of Illinois was the first such environment where the user stepped inside the chamber to experience a virtual world..

At the augmented level, the virtual world is created inside a simulated setting, such as a flight

simulator. Users interact with this type of virtual reality using real world artifacts such as joysticks or special equipment. This type of technology has been used by the military for many years for training.

Desktop virtual reality (desktop VR) is most commonly found in education. The computer desktop is used to create the setting to view the virtual world without placing users into that environment. They are free to navigate around the virtual setting using standard computer interfaces. Often what is available is a 360-degree view it from any angle and get a perspective that would simulate seeing the actual item or setting.

The essence of virtual reality is the expansion of experiences. Because virtual reality places users into the virtual environment, it provides them an opportunity to interact with that environment in a unique way, giving them the" ultimate" chance to grasp new ideas. For example, students can take a virtual field trip to a city without leaving their classroom.

Advantages

Safety. Virtual reality creates a realistic world without subjecting viewers to actual or imagined danger or hazards.

Expansive. It provides students with opportunities to explore places not feasible in the real world (e.g., outer space or inside an active volcano).

Opportunities to explore. Virtual reality allows students to experiment with simulated environment.

Limitations

Cost. The equipment is extremely expensive for the complex environments.

Complexity. The technology is very complex and does not lend itself to most classroom users, with the exception of desktop VR.

[1]This content is available online at <http://cnx.org/content/m34297/1.2/>.

Limited titles. There are limited software ‘realities” available at this time, although the number is growing almost daily.

Integration

Computer-controlled environments allow users to experience multisensory immersion and to interact with certain phenomena as they would in the physical world. Several applications of virtual reality have been demonstrated to be highly effective. One such application is in the area of space exploration. Because virtual reality can simulate the outer space environment, the user can practice exploring space safely and efficiently. Without this type of technology, such an experience would be impossible for all of us.

The most visible applications of VR have been high-fidelity simulators for airplane and Space Shuttle flight training and tank warfare training. VR also allows people to experience things not possible in the physical world.. They can take a virtual ride through the human circulatory system or can tour an ancient Mayan civilization. VR has also found successful applications in health care, architecture, interior design, city planning, product design, and all sorts of activities involving visualization (McLellan, 1996). One applications found at the school level is the “virtual field trip.” Adaptive technologies for special education are also being developed and tested.

Virtual reality is showing great promise in education because of the availability of software to create the virtual worlds. QuickTime VR utilizes several tools that allow students to create unique realities using simple tools. A digital camera on a special tripod attachment lets the student take photographs of an environment in a 360-degree perspective. Computer software ‘stitches’ the digital pictures together and creates a special movie. When viewing the movie, the user can, with a simple movement of the mouse, move the picture in any direction. This gives the user the feeling of standing in a spot and around looking in any direction.

Virtual reality has shown great promise in the area of medicine. The virtual hospital provides training and updating for medical professionals throughout the country. Given that most hospital staff cannot leave their assigned duties for any length of time, a training climate that simulates the hospital environment while helping staff to upgrade their skills is ideal. The virtual hospital also provides information new techniques and resource that might prove valuable in particular settings.

Some virtual reality applications are appropriate for schools. One example is a math program that lets students explore solutions to problems by actually manipulating the variables. Students experience algebraic concepts by moving numbered cubes in space, thus developing a unique understanding of the concepts.

Beyond simply manipulating the numbers to solve problems, this math program lets the teacher decide if it should correct the students when they make an error. The teacher may decide to let the computer program ignore only certain types of errors to let the students discover the mathematical relationships for themselves.

The three-dimensional rooms, or caves, where the user actually stands within the virtual environment, experiencing it from a total three-dimensional perspective, are often used for scientific study. Such applications as neurobiology and pharmacology have capitalized on this technology. Now scientists can enter a cell and manipulate or insert molecules and then observe the results of these actions.

The potential for this type of technology in the area of special education is exciting. Providing safe yet detailed lifelike learning experiences for students with learning problems has promise. As virtual reality tools improve and their costs decrease, students and teachers will be able to explore ways of using this type of technology in learning. It will become possible for them to create their own unique environments. These types of experiences will add to the dimensions of the classroom in exciting ways.

Chapter 6

Expert Systems[1]

Expert Systems

Almost immediately after computer became a reality, scientists were intrigued by what they saw as parallels between how the human brain works and how the computer processes information. They wondered whether the computer could "learn" as well as retrieve and collate information. Their experiments led to computers playing games such as checkers and chess with human experts-and winning. Then they explored whether the computer could enable an amateur to play on an equal footing with an expert. It certainly could. But, they reasoned, why limit this capability to playing games? Why not see if this "artificial intelligence" could be applied to more useful problems?

This line of experimentation led to the development of the so-called expert system. This is a software package that allows the collective wisdom of experts in a given field to be brought to bear on a problem. One of the first such systems to be developed was MYCIN, a program that helps train doctors to make accurate diagnoses of infectious diseases on the basis of tests and patient information fed into the computer. Expert systems are rapidly making their way into education.

Scholastic Publications has developed a unique program that leans the rules of any game as it plays with its human partner. The student may play the game with self-chosen rules but must identify for the computer the criteria for winning the game. The computer absorbs the rules and eventually wins. Another expert system, the Intelligent Catalog, helps a student learn to use reference tools. Any learning task that requires problem solving (e.g., qualitative analysis in chemistry) lends itself to an expert system. SCHOLAR is an expert system on the geography of South America. It is an example of a "mixed-initiative" system. The student and the system can ask questions of each other, and SCHOLAR can adjust its instructional strategy according to the context of the student's inquiry.

One example that involves individualized learning is an expert system called CLASSLD. Developed at Utah State University, the program classifies learning disabilities by using an elaborate set of rules contributed by experts. In tests, the program has proven to be at least as accurate as informed special education practitioners. The next step is to use a software package that will design an individualized education program (IEP) for children diagnosed by CLASSLD. Because many children with learning disabilities are included in regular chasses, the expert system would make more manageable the classroom teacher's job of providing appropriate instruction. The school benefits from more effective and more efficient decision making.

Further down the road is an expert system the\at could truly individualize learning. We can imagine a system that learns all the important aptitudes and personality traits of an individual. When presented with a large body of material to master, the learner would use the expert system as a guide to learning the content in the most effective manner. The program would adjust the content, instructional method, and medium to the learning styles of the student. The learner, not the experts, would be in charge of the program. When this becomes possible, we will really have individualized learning.

[1]This content is available online at <http://cnx.org/content/m34298/1.1/>.

A professional specialty has emerged from the development of expert systems. The term knowledge engineers has been coined to describe the people who work with experts in a field to assemble and organize a body of knowledge and then design the software package that makes it possible to train someone to become skilled in the area or to enable anyone to call on the skills of experts to solve a problem. The work of knowledge engineering is similar to that done by instructional designers in task analysis and module design.

Index of Keywords and Terms

Keywords are listed by the section with that keyword (page numbers are in parentheses). Keywords do not necessarily appear in the text of the page. They are merely associated with that section. *Ex.* apples, § 1.1 (1) **Terms** are referenced by the page they appear on. *Ex.* apples, 1

Attributions

Multimedia
The generic term multimedia refers to the sequential or simultaneous use of a variety of media formats in a given presentation or self-study program.