This chapter covers the following topics:

- Definitions and characteristics of multimedia and hypermedia systems
- Unique advantages and instructional uses of five types of multimedia/hypermedia resources: commercial CD-ROM and DVD multimedia software packages, commercial interactive videodiscs, presentation software, digital video systems, and various multimedia/hypermedia authoring systems
- Procedures for developing multimedia/hypermedia products using various authoring systems
- Educational applications of multimedia/hypermedia authoring systems

Multimedia learning is not something new. It is woven into the fabric of our childhood.

Tom Boyle in Design for Multimedia Learning (1997)

Technology is the campfire around which we will tell our stories.

Laurie Anderson
Objectives

1. Define multimedia and hypermedia from historic and current perspectives.
2. Design classroom lesson activities appropriate for each kind of multimedia/hypermedia product.
3. Evaluate the quality and capabilities of a commercial hypermedia product.
4. Use an authoring system to develop a product that meets visual, navigation, and instructional criteria for effective hypermedia-based instruction.
5. Design lesson activities appropriate for student development of hypermedia products.

Introduction to Multimedia and Hypermedia

We live in a multimedia world, surrounded by complex images, movement, and sound. So perhaps it is not surprising that part of our human evolution has focused on making our technology reflect the color and clamor of our surroundings. In educational technology, multimedia has been a steadily growing presence for some time. As discussed in Chapter 1, computer-based multimedia learning stations have been used since 1966, and noncomputer multimedia methods have been around even longer. This chapter looks at current classroom uses of electronic multimedia and its companion concept, hypermedia.

Multimedia and Hypermedia: How Do They Differ?

Like other educational technology concepts, definitions for multimedia and hypermedia defy consensus (Moore, Myers, & Burton, 1994; Tolhurst, 1995); people find the two concepts either too close to distinguish between or too slippery to get words around. Tolhurst quoted one source as saying, “By its very nature, [multimedia] is invertebrate. You poke it and it slithers away” (p. 21). Definitions used in this chapter come to us from two paths that were separate initially but have converged over time.

Multimedia simply means “multiple media” or “a combination of media.” The media can be still pictures, sound, motion video, animation, and/or text items combined in a product whose purpose is to communicate information.

Hypermedia refers to “linked media” that have their roots in a concept developed by Vannevar Bush (1986) in his landmark article “As We May Think.” In 1945, Bush proposed a “memex” machine that would let people quickly access items of information whose meanings were connected but which were stored in different places. In the 1960s, Ted Nelson coined the term hypertext to describe a proposed database system called Xanadu based on Bush’s idea (Boyle, 1997). In this system, items of information from all over the world were to be logically connected with hypertext links. For example, one could select “apple” and get information on all related concepts such as trees, fruit—even the Garden of Eden. The technology at that time was inadequate to produce Xanadu, but the idea was the forerunner of today’s hypermedia systems in which information stored in various media are connected (often via the Internet), thus the term hypermedia.

In current technologies such as Internet browsers (see Chapter 8) and authoring systems, most multimedia products also are hypermedia systems. That is, the media elements are linked with buttons to click on or menus from which to select. Clicking on or selecting one item sends the user to other, related items. This chapter gives many examples of hypermedia products; all also are multimedia. The combination of media such as video and audio with text makes them multimedia; the ability to get from one media/information element to another makes them hypermedia.

Types of Multimedia and Hypermedia Systems

Multimedia and hypermedia systems come in a variety of hardware, software, and media configurations and, until recently, were usually classified according to their primary storage equipment: interactive videodiscs (IVDs), CD-ROMs (compact disc–read-only memory), digital versatile discs (DVDs), and other technologies, including CD-I (compact disc–interactive), DVI (digital video interactive), and photo CDs (photographic compact discs). However, dramatic changes in the capabilities of presentation software and Internet multimedia formats, as well as the decline in use of videodisc systems, have changed the focus of this classification system. The medium on which multimedia is presented has become less important than its purpose and the type of capability it offers.

This chapter focuses on five kinds of multimedia/hypermedia formats. The first two are developed by companies and sold to educators and other consumers; the other three are authoring systems that educators and others can use to develop their own products.

- Commercial multimedia/hypermedia software packages. These are pre-packaged products developed by software publishing companies and offer a variety of media, including animation, video, audio, and links to the Internet. The trend is for most software packages to include all these features.
- Commercial interactive videodisc packages. Until the emergence of CD-ROM and DVD storage media, interactive videodiscs were the storage medium of choice for full-motion video in combination with text and still pictures. Because of the large number of IVD curriculum discs and videodiscs players that remain in schools, this technology is still in use.
- Authoring tools: presentation software. This authoring software used to be linear and primarily a combination of text, still pictures, and limited audio and animation. But it has grown in capability and now offers branching capabilities and the ability to include many of the same features as published products (e.g., embedded audio and video clips).
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- **Authoring tools: video production and editing systems.** Digitized videos used to be difficult to produce and edit and were used primarily to capture short video clips for use in multimedia/hypermedia authored. New video editing systems have changed this. Now anyone, even nontechnical consumers, can produce professional-looking movies with a variety of special effects like fading and titles.

- **Authoring tools: multimedia/hypermedia authoring systems.** These systems, too, have come a long way since the first versions. They are increasingly capable, allowing users to include many of the features they see in professional products with substantially greater ease.

Hypermedia systems published as web page documents also represent a powerful technology of the future. Hypermedia systems used in distance communications and online learning are described in Chapter 8.

**Current and Future Impact of Multimedia and Hypermedia on Education**

The current widespread educational uses of multimedia and hypermedia systems augur an even heavier reliance on these products in classrooms of the future. Educators recognize and use these systems when they see the powerful capabilities they offer to enhance classroom learning:

- **Motivation.** Hypermedia programs offer such varied options that most people seem to enjoy using them. Students who usually struggle to complete a project or term paper often will tackle a hypermedia project enthusiastically. McCarthy (1989) is among those who believes the most important characteristic of hypermedia is its ability to encourage students to be proactive learners.

- **Flexibility.** Hypermedia programs can draw on such diverse tools that they truly offer something for students who excel in any of what Gardner calls “intelligences” (see Chapter 3). For example, a student who may not be good at written expression but has visual aptitude can document learning with sound or pictures.

- **Development of creative and critical thinking skills.** The tremendous access to hypertext and hypermedia tools opens up a multitude of creative avenues for both students and teachers. Marchionini (1988) refers to hypermedia as a fluid environment that constantly requires the learner to make decisions and evaluate progress. He asserts that this process forces students to apply higher order thinking skills. Turner and Dipinto (1992) report that the hypermedia environment encourages students to think in terms of metaphors, to be introspective, and to give free rein to their imaginations.

- **Improved writing and process skills.** Turner and Dipinto (1992) also find that exposure to hypermedia authoring tools helps students by giving them a new and different perspective on how to organize and present information and a new insight into writing. Instead of viewing their writing as one long stream of text, students now see it as chunks of information to be linked.

Our society’s heavy reliance on hypertext/hypermedia to communicate information seems likely to expand in the future. The accelerating number of World Wide Web pages on the Internet is evidence that linking data with hypertext and hypermedia is an effective way to present and add value to large bodies of information. Millions of people have published hypermedia documents on the Information Superhighway in the hope of attracting viewers, readers, and listeners.

Hypermedia tools also may permit sophisticated evaluations of learning. In the process of using hypermedia, people are said to “leave a track” (Simonson & Thompson, 1994), which may help teachers analyze how students approach learning tasks. Future hypermedia systems might apply pattern-recognition techniques from the field of artificial intelligence to help schools assess student mastery of higher order cognitive skills (Dede, 1994). Bagui (1998) says multimedia “may have unique capabilities to facilitate learning because of the parallels between multimedia and the natural way people learn” (p. 4), that is, through visual information and imagery.

**Research on the Impact of Multimedia and Hypermedia Systems**

While some reviewers have tried to capture the unique contributions of these systems on achievement (Adams, 1992; McNeil & Nelson, 1991), Lookatch (1997) echoes Clark’s warning (see Chapter 1) that instructional strategies—not media—will make the difference in achievement. In summarizing research reviews of findings that could guide future educational uses of multimedia/hypermedia, Roblyer (1999) found that multimedia’s benefits seem to center on its ability to offer students multiple channels through which to process information. However, researchers are cautious about recommending multimedia to support specific kinds of learning.

Swan and Meskill (1996) examined how effectively current hypermedia products support the teaching and acquisition of critical thinking skills in reading and language. They reviewed hypermedia products as to how well they made possible response-based approaches to teaching and learning literature, that is, instructional activities that “place student-generated questions at the center of learning . . . (and encourage) a problem-finding as well as a problem solving approach to critical thinking” (p. 168). They evaluated 45 hypermedia literature programs using criteria in three areas: technical items, response-based concerns, and classroom issues. The majority of the 45 products used a CD-ROM format, but 10 used a combination of CD-ROM and videodisc, and four used computer software. They found that most products were technically sound and linked well with classroom topics, but few were designed to promote the response-based methods that promote critical
thinking. “Programs designed for elementary students . . . equated literature education with reading instruction; programs designed for high school . . . generally adopted a traditional text-centered approach” (p. 187). These findings indicate that teachers who want to use multimedia/hypermedia products specifically to promote higher level skills must select products judiciously and warily.

In another review of the impact of hypermedia on learner comprehension and learner control, Dillon and Gabbard (1998) echo the caution voiced by Swan and Meskill. They conclude that:

- Hypermedia’s primary advantages accrue to students doing rapid searches through lengthy or multiple information resources. For other purposes, hypermedia and nonhypermedia resources seem equally useful.
- Increased learner control is more useful to higher ability students; lower ability students experience the greatest difficulty with hypermedia.
- Learner style helps determine whether or not certain hypermedia features are effective in various learning situations. Passive learners may profit more from the cueing offered by hypermedia, while more capable learners who are more willing to explore may be more capable of exploiting other hypermedia features.

Research on the Design of Multimedia and Hypermedia Systems

Stemler (1997) reviewed findings on various multimedia/hypermedia characteristics that could have an impact on the potential effectiveness of these systems: screen design, learner control and navigation, use of feedback, student interactivity, and video and audio elements. Her findings are too extensive to give adequate treatment here, but educators who are committed to high-quality multimedia development should review the full text of her article.

- **Instructional design.** Stemler recommends that developers analyze each element in a multimedia product to determine which of Gagné’s nine Events of Instruction (see Chapter 3) it aims to achieve and how well it achieves it.
- **Screen design.** Well-designed screens focus learners’ attention, develop and maintain interest, promote processing of information, promote engagement between learner and content, help students find and organize information, and support easy navigation through lessons (p. 343).
- **Interaction and feedback.** Keep feedback on the same screen with the question and student response and provide immediate feedback. Verify correct answers and give hints and another try for incorrect answers. Tailor feedback to the response and provide encouraging feedback, but do not make it more entertaining for students to provide wrong answers rather than correct ones. If possible, let students print out the feedback (p. 345).

- **Navigation.** Support navigation with orientation cues, clearly defined procedures, clearly labeled back-and-forth buttons, and help segments (pp. 346–347).
- **Learner control.** In general, give older and more capable students more control over the sequence; younger, less experienced students should have less control (p. 348).
- **Color.** Use color sparingly and employ it primarily for cueing and highlighting certain elements to bring them to the learner’s attention. Use a consistent color scheme throughout to promote ease of use (pp. 350–351).
- **Graphics.** Use graphics as well as text to present information to serve students who prefer one kind of presentation over the other. Use graphics sparingly for other purposes (to entertain or amuse) (p. 351).
- **Animation.** Use animation sparingly and only to present dynamic processes or to highlight key information (p. 352).
- **Audio.** Use audio for short presentations of program content, but do not let it compete with video presentation. Do not require long readings on each screen. Separate material into chunks on each of several screens (p. 353).
- **Video.** Use video sequences for broader, abstract material (that with emotional impact) and for advance organizers rather than for presenting detailed information (p. 354).

Mayer and Moreno (1998) reported yet another study focusing on multimedia design issues. They found that learners using multimedia materials showed greater comprehension and retention of learned materials when pictures were accompanied by spoken words, rather than written words. They observed that this “split attention” effect was consistent with a model of working memory that had separate visual and auditory channels. Therefore, learners did not process image and text information when it was presented through the same channel (visual). More studies of this kind are urgently needed to guide design strategies for hypermedia products.

Emerging Developments in Storage Media for Multimedia Systems: Compact Disc–Read-Only Memory and Digital Versatile Disc

In recent years, CD-ROMs and DVDs have replaced computer disks and videodiscs as the most popular storage media for motion video, as well as text, sound, and graphics of all kinds. Consumers now receive most software packages on CD rather than computer disk, and DVDs have replaced videotapes as the storage medium for movies. CD-ROM and DVD technologies all share a single core technology: Laser beams heat light-sensitive material on a disc so that a chemical reaction causes the area to either remain opaque or reflect light, thus revealing encoded information. In contrast, magnetic storage units, such as hard disks and tape devices, store data as magnetic pulses, which are read or al-
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tered by the disk drive. Generally accepted style in the industry has adopted the spelling disk for magnetic storage systems and disc for optical devices.

CD-ROMs. As music media, CD-ROMs have become as commonplace in the lives of young people as phonograph records were to their parents and grandparents. But CD-ROMs have additional capabilities undreamed of in the days of record albums and turntables. Commonly called compact discs or CDs, CD-ROMs are made of the same material as videodiscs but are smaller in size, just 4.72 inches (12 cm) in diameter. In appearance, CD-ROMs look identical to audio CDs. The main practical differences between an audio CD and a CD-ROM are what they can store and how they are used. Both store data in digital form. But audio CDs store sound, whereas CD-ROMs store text, audio, video, animation, and graphics information. CD-ROMs are known for their huge storage capacity, up to 650 MB of data, which equates to the equivalent of 250,000 pages of text, or five hundred 500-page novels. Computer systems get access to CD-ROMs through either internal or external CD-ROM players.

CD-ROM technology has adapted to allow users to store data on them as well as use them for prestored applications. Because CD-ROMs hold so much more information than disks, they are becoming valuable additions to schools’ collections of storage devices, and readable/writable CD-ROM drives are becoming commonplace.

DVDs. These media look like CD-ROMs but have much greater storage capacity: currently from 4.7 GB (single sided, single layered) to 14 GB (double sided, double layered). Like CD-ROMs, DVDs began with a read-only format but are rapidly taking the place of computer disks, hard drives, and even videotapes and CD-ROMs. They are able to store high-quality video as well as audio and text data, thus making them valuable to multimedia developers in education and elsewhere. Also, they are replacing videotape as storage media for commercially produced movies and films.

As storage media continue to evolve in capability and decrease in price, they will have a significant impact on the kinds of multimedia/hypermedia that teachers can develop. DVD technology is projected to become an important storage medium in the future, taking the place of current CD-ROMs and even hard drives. This will allow educators to include more multimedia elements, especially video sequences, which currently take up more room than may be available.

Issues Related to Multimedia and Hypermedia Use in Education

Educators have voiced several concerns recently about our media-driven culture and its role in education. A few of these are described here.

The critical importance of media literacy. As Mergendollar (1997) warns, technologies such as multimedia are an equivocal blessing. They help us communicate information more expeditiously but do not help us analyze whether or not information is accurate, relevant, or current. The more information we have, the more important it becomes to learn critical analysis, visual literacy, and information literacy skills.

Limitations of hypermedia. Although multimedia/hypermedia systems truly represent the communication method of choice both now and in the future, education’s use of these resources is hampered by several problems:

- **Hardware intensity.** To take full advantage of the benefits of hypermedia technology, students need ample online development time. This presents a problem in most classroom settings due to insufficient numbers of computers. The problem is exacerbated when available computers are not configured for hypermedia authoring. For example, they may lack the capacity to digitize sound or to input video.

- **Lack of training.** Although hypermedia programs are becoming easier to use, they still require extensive training. Unfortunately, training is not a top priority in most school districts. One survey showed that staff development makes up only about 8% of technology budgets (Siegel, 1995). The toughest challenge instructional personnel face is not learning to use a particular program, but learning to integrate it within the curriculum. To help alleviate this problem, hypermedia training needs to go beyond just learning how to make an authoring program work. Training must also give serious consideration to effective curriculum integration. In addition, to ensure quality products, hypermedia training should extend to the areas of media, design, and the arts.

- **Projection needs.** Teachers often want to project students’ hypermedia projects onto large screens so that others can see the results. For this, the teacher must hook up an LCD panel or a video projector to the computer. This requires an additional piece of hardware, so not every classroom may not have a projection setup. A compromise solution may be to use a converter that can project the computer signal onto a large television/monitor.

- **Integration problems.** Integration of hypermedia technology into the curriculum presents some major problems. To ensure quality projects, students need sufficient time to focus, build, and reflect. The conventional school schedule, often broken into 50-minute blocks, does not lend itself to serious project development. If hypermedia authoring is to have a major impact on learning, educators will need to look at ways of infusing more flexibility into students’ daily schedules. One step in the right direction might be more integration of subject matter into interdisciplinary projects.

- **Memory and storage problems.** A hypermedia project can fill a tremendous amount of storage space on a
computer’s hard drive; digitized video and sound files are the major culprits. Until the compression techniques promised by DVD improve and become more cost effective, this problem will persist. Another component of this problem is the difficulty of transferring a file from one computer to another, because even very small hypermedia files will exceed the capacity of a single data disk. There are some ways of getting around these problems. Students can store files on external hard drives or zip disks. These add another cost element, but the prices are dropping rapidly.

### Commercial Multimedia/Hypermedia Software Packages

#### Background on Commercial Multimedia/Hypermedia Software Packages

As noted in Chapter 4, instructional software is becoming increasingly multimedia and hypermedia in nature. Software tools have also seen an increasing emphasis on this format. The increased storage capability and availability of CD and DVD media has made it easier to store complex programs with motion graphics, movies, audio, and links to the Internet. Software used to be produced primarily by writing code in a computer language. Today’s software is frequently produced with an authoring system such as Macromedia Director. The number of titles in the CD-ROM and DVD market has increased at a phenomenal rate during the past few years and will continue to grow. The Multimedia Compendium from Emerging Technologies (http://www.emergingtechnology.com) is a frequently updated catalog of current offerings. (See Figure 7.1.) Currently, several popular categories of multimedia/hypermedia-based products are used in classrooms.

#### Instructional Software

A single CD-ROM can store the equivalent of eight hundred 3.5-inch computer disks. This makes CD-ROM a wonderful technology for distributing more memory-intensive instructional software. Some companies have taken advantage of this added capacity by enhancing successful programs with multimedia features and Internet links, for example, Sunburst’s Multimedia: The Human Body. (See Figure 7.2.)

#### Interactive Storybooks

These on-screen stories have become extremely popular with primary teachers and students (Glasgow, 1996, 1996–1997, 1997; Kahn, 1997). On the audio tracks, narrators read pages as the words are highlighted on screen. If a student needs to hear a word again, just clicking on it with the mouse pointer will activate the audio. Some electronic storybooks have a straightforward approach, allowing students to read them at their own pace. Other books are structured to be more interactive and open ended, some allowing students to choose the story path and ending they want each time the story is read. A recent study by Doty, Popplewell, and Byers (2001) found that students’ ability to answer comprehension questions was higher when they read stories in an electronic storybook format than when they read a traditional book format.

#### Reference Materials

Many reference materials are available on CD and DVD at very reasonable costs. To add still more value, these resources are accompanied by search engine software that makes searching for information both easy and efficient. Some materials have Internet links to still more material. Below are just a few of the categories and example titles.

**Encyclopedias.** Most of the major encyclopedias are no longer published exclusively in book format; they are available on CD and DVD. Some like Microsoft’s Encarta were designed solely for the electronic format and are available only on disc or the Internet. However, others such as the World Book Encyclopedia now have a version on disc after many years in book format. (see Figure 7.3.) Many, like World Book, also have Internet versions or supplements.

**Almanacs.** Popular information collections such as The Time Almanac are increasingly shifting to electronic format. Some, such as the CIA World Factbook, are on the Internet.

**Atlases.** Map utilities such as the Picture Atlas of the World allow teachers and students to do a variety of interactive activities such as determining distances and routes from one location to another.

#### Collections of Development Resources

Many collections of resources used to develop multimedia are now shipped on CD-ROM. These include collections of...
clip art, sound effects, photographs, video clips, fonts, and document templates. Also, some major technology conferences, like the National Educational Computing Conference (NECC), distribute to each registrant proceedings, presenter handouts, vendor samples, and shareware on CD-ROM.

**Integration Strategies for Commercial Multimedia/Hypermedia Products**

Because products in this category vary so widely, instructional uses for them are also varied and rich. Integration strategies for instructional software are discussed in detail in Chapter 4, and strategies for software tools are described in Chapter 5. Technology Integration Ideas 7.1 and 7.2 illustrate ways some of the commercial multimedia/hypermedia resources are being used in classrooms.

**Commercial Interactive Videodisc Systems**

**Background on IVD Systems**

Videodiscs are optical storage media for random-access storage of high-quality audio and analog information. Laser videodiscs can store text, audio, video, and graphics data in analog format. Interactive videodisc (IVD) technology was first released in the 1970s and now has applications in both the education and business worlds. A videodisc resembles an audio CD disc, except it usually is larger in diameter. Most videodiscs are 12 inches in diameter and hold 54,000 still frames or the equivalent of 675 carousel slide trays. They represent a durable medium for storing and displaying visual information. Videodiscs are read by a laser beam, and the mechanism allows random access to any part of the disc. The random access feature is important because it avoids the need to fast forward or rewind to find a particular image as is necessary with a videotape.

**IVD past, present, and future.** Optical disc technology was first introduced by the Dutch firm NV Philips in 1972, leading to the release of a commercial product in 1976. Videodiscs were initially marketed as media to show movies at home. Soon after they got started in the consumer market, however, relatively low-cost VCR technology became available and emerged as the medium of choice for
Hypermedia Projects with Multimedia/Hypermedia Reference Software Tools

**TITLE:** Tracking Down Trivia—A World Scavenger Hunt

**CONTENT AREA/TOPIC:** Research and study skills

**GRADE LEVEL:** Fourth through sixth

**NETS FOR STUDENTS:** Standards 1, 3, 4, 5

**DESCRIPTION:** This activity is designed to improve student skills in using CD-ROM-based encyclopedias for research. Pass out copies of a list of questions like the following to the class. Have students work in pairs on a “scavenger hunt” for information. Using an atlas and/or encyclopedia as resources, have them look up the answers to the questions. If appropriate, inject an element of competition in the activity by offering incentives to all those who answer the most questions correctly during class.

1. What is the capital city of Sweden?
2. What was E. B. White’s first name?
3. Who won the Nobel Prize for Peace in 1985?
4. When did the Japanese bomb Pearl Harbor?
5. How did John Paul Jones die?
6. What is the state flower of Utah?
7. What does illiterate mean?
8. What gases make up the atmosphere of Jupiter?
9. What movie won the Academy Award for best picture in 1985?
10. What is a synonym for the word supercilious?
11. What is the chemical formula for sulfuric acid?
12. If Babe Ruth had lived 20 years longer, how old would he have been when he died?

Source: Contributed by Jack Edwards.

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Hypermedia Projects with Multimedia/Hypermedia Reference Software Tools

**TITLE:** Research Detectives

**CONTENT AREA/TOPIC:** History

**GRADE LEVEL:** Seventh through twelfth

**NETS FOR STUDENTS:** Standards 1, 3, 4, 5

**DESCRIPTION:** This activity can help develop students’ skills at locating and analyzing historical information. Distribute to small groups of students copies of a scenario involving a “theft problem” they must solve. Provide access to a CD-ROM player and a variety of CD-ROM reference tools. Microsoft’s Bookshelf is excellent for this activity since it contains an encyclopedia, dictionary, almanac, atlas, and other resources—all on one CD-ROM. The scenario should include a list of suspects whose descriptions include high-level vocabulary and ambiguous facts that require students to use the reference resources to read up on the history cited, locate discrepancies in the suspects’ stories, and analyze them to determine which suspect must be lying. Another way to do this type of project is to have students write their own scenarios, which could then be published and shared with other classes to develop their research and analytical skills.

Source: Contributed by Jack Edwards.
Levels of interactivity. The level of interactivity of a videodisc program refers to the amount of control the program gives the user and what kinds of software and hardware the user needs to achieve control. Videodisc programs come in Level I and Level III formats. Level I, the most popular format, requires only a videodisc player and a bar-code reader to use the curriculum videodiscs designed for it. Level III requires a computer connected to a videodisc player with special cables.

The explosion of CD-ROM technology has been predicted to eclipse videodiscs, and these predictions will doubtless come true eventually. However, teachers still find Level I IVD technology an easy-to-use and effective tool. This format seems to be gradually moving to DVD players with bar-code readers. On the other hand, the future of Level III IVD seems short lived because of its awkward hardware configuration; schools will likely prefer the simpler interactive multimedia platform. Videodiscs that once were used as Level III resources may change roles to that of presentation tools and Level I uses.

Advantages of IVD Technology

IVD supports a variety of applications for teachers and students. The control options, as well as the unlimited creative potential of repurposing videodiscs by selecting bar codes from them, allow this tool to integrate effectively into most curricula. Advantages of IVD include the following:

- **Dual audio tracks.** Developers often use the second track to play program audio in a second language (usually Spanish) or to include a simpler or more detailed version of the presentation. The teacher can then let some students listen to one track through headphones while the rest of the class listens to the other track through the monitor.
- **Ease of use.** Most teachers and students feel comfortable enough to begin using Level I IVD technology with only a few hours of training. However, they may become fully comfortable only after many hours of use. Some schools allow teachers to check out videodisc players for practice at home as a means of encouraging them to use the equipment in their classrooms.

Disadvantages of IVD Technology

- **Cost.** The cost of some videodisc programs can be quite high (e.g., $300 to $500 or more). This presents a big problem when a school’s media purchasers see these programs simply as videos. Someone who can pay $49.95 for a videotape may balk at the cost of a videodisc. Schools should evaluate these higher end videodisc programs as curriculum packages, rather than just discs.
- **Read only.** The videodisc is a read-only technology, which means that users cannot record information. This is an obvious disadvantage compared to the VCR or writable CDs.
- **Hardware-intensive systems for Level III.** A Level III setup includes a videodisc player, monitor, computer, and cables. Teachers often find it burdensome to gather all of this equipment in one place. Some schools have opted to create portable multimedia stations that can easily be transported from one classroom to another. Level III interactivity also presents a cumbersome interface for the user who must pay attention to two monitors—the computer screen and the television screen.
- **Maintenance costs.** Videodisc players can be expensive to repair, and users should handle them with care. However, the industrial players sold to schools are designed to be more durable than home players.
- **Limited video capacity.** Although videodiscs provide tremendous storage capacity for still frames, when played as continuous video, the CAV format offers only 30 minutes per side. A complete movie can fill three, four, or even five separate discs.

Classroom Uses of IVD Systems

Using bar codes. Users can scan bar codes to access chapters, individual frames, or segments of video on both CLV and CAV discs. (See Figure 7.4.) The bar codes look like UPC codes on commercial-use products. The bar-code reader that interprets the patterns of stripes resembles the technology in many stores. Bar codes are considered the easiest way to access information from videodisc. They simplify control of the technology so the teacher can
concentrate on interacting with the students without worrying about entering frame or chapter numbers with a remote control device. Vendors have taken advantage of these capabilities and now include bar codes with most Level I programs. A good example of the power of bar codes emerged when Optical Data Corporation upgraded its *Windows on Science* program. By indexing discs with bar codes, the company turned a potentially cumbersome program into one that teachers find both exciting and easy to use.

A number of software packages for Macintosh, Windows, and DOS systems (*Bar’n’Coder 3.0, Barcode Maker, Lesson Maker*) enable users to create bar codes for videodiscs. Most of these programs work similarly. The user enters the frame or time-code numbers to display and then types in a descriptor for the bar code. At the user’s command to make the bar code, the program either prints it out or exports it to a word processing document.

Once the bar code is generated, it can be used in many ways. A teacher might create bar codes that access data on a videodisc dealing with geography and then glue the bar codes on appropriate parts of maps. This becomes an exploration center for students. Another instructor might use the computer to paste the bar code into a word processing file and then scan it during a teacher-directed activity. Bar-code software can also make bar codes for an audio CD. Videodisc players sold since 1992 support the LB2 standard. They can play audio CDs under control of bar codes that match the standard. The “address” for the audio CD shows up on the TV monitor hooked up to the videodisc player. Users can enter this information into the bar-code program as they do for a videodisc frame to get to a specific part of the audio CD.

**Interactive curriculum.** Perhaps the most ambitious use of videodisc technology has been the development of entire curriculum packages around Level I technology. Examples include Optical Data Corporation’s *Windows on Science* program, now in wide use, with *Windows on Math* and *Windows on Social Studies*. Some states now allow school districts to adopt these programs in lieu of textbooks. D. C. Heath’s *Interactions* program uses video technology to bring interactive examples of math applications in real-world settings.

**Problem solving.** Discs such as Videodiscovery’s *Science Sleuths* (see Figure 7.5) and *Math Sleuths* provide students with mysteries to solve. The videodisc programs offer clues in the form of interviews, textual and numeric data, photographs, and diagrams. The teacher plays an active role in guiding students via questioning techniques and just-in-time teaching.

**Simulations.** Optical Data’s *Adventures of Jasper Woodbury* teaches middle school math with a series of simulated scenarios. Students solve real-world applied math problems by retrieving data embedded in the stories. Bar-code technology comes in handy, since it enables students to review segments from the story as needed. It is designed so that the teacher can stop the action and teach certain math techniques just when needed to solve techniques problems.

**Visual databases.** Visual databases are collections of individual pictures and short video segments. *BioSci II* was one of the earliest examples of this type of program. These databases are perhaps most useful in the areas of science and art and provide a wealth of resources for both teacher presentations and student projects.

**Movies and documentaries.** Schools can choose from thousands of movies, documentaries, and other general-use videodiscs at reasonable prices. These resources can yield tremendous educational benefits. Through the search feature controlled by the remote control, a teacher can access any frame or segment of a disc almost instantly. The random-access capability of the technology holds great promise for encouraging sound pedagogical uses of video as opposed to playing movies straight through.
Student presentations. Videodiscs allow students to create their own illustrated presentations on topics they have researched or books they have read (Thorpe, 1993). This is a kind of repurposing, in which students present selected frames to support and enhance their reports.

Integration Strategies for IVD Systems

Technology Integration Ideas 7.3 and 7.4 illustrate some of the many current uses for IVD multimedia/hypermedia resources.

### Hypermedia Projects with Commercial IVD Systems

**TITLE:** A Capital Idea—Problem Solving with Jasper Woodbury

**CONTENT AREA/TOPIC:** Mathematics in problem solving

**GRADE LEVEL:** Middle school

**NETS FOR STUDENTS:** Standards 1, 3, 4, 5, 6

**DESCRIPTION:** The activity described here is based on one of the Jasper Woodbury videodisc scenarios, “A Capital Idea.” The problem the students must solve is to replace money the city can no longer provide to support class trips. The students are challenged to propose a citywide recycling plan to raise the funds and present the plan to the mayor. The emphasis in this activity is on group work and cooperation. Before beginning the work, the teacher divides the students into small groups and tells them they should develop collaborative skills within their team of listening, sharing ideas, and encouraging participation. They discuss what these skills look like in action and that working together is important to solving the problem. Then they begin the seven-stage activity: Focus (watch the video), gather information to solve the problem, organize the information and determine what is missing, analyze information for relationships, review the video for further information, synthesize information and form a problem solution, and prepare presentations that provide a problem solution.


### Hypermedia Projects with Commercial IVD Systems

**TITLE:** The Salt Quest—A Persuasive Presentation

**CONTENT AREA/TOPIC:** The Environment

**GRADE LEVEL:** Fifth through twelfth

**NETS FOR STUDENTS:** Standards 1, 3, 4, 5, 6

**DESCRIPTION:** Pass out a copy of the following scenario to the students. Ask them to read it.

Military commands all over the world are in a state of high alert. A fleet of alien spacecraft has been lurking just outside earth’s atmosphere for the past two days. An organization called “What’s Up”—a think tank composed of highly educated men and women who for years have been convinced that extraterrestrial life exists—was asked to contact the aliens to see what they wanted. The spacecraft are from a planet called Nacl, which is in another solar system. The inhabitants of Nacl require tremendous amounts of salt to exist. They are getting close to depleting their own supplies and have been on a long search for new supplies. They have noticed that the earth’s oceans are full of salt, so they thought that they would help themselves to this huge supply. You are a committee of “What’s Up” members that must persuade the Naclites that it would not be a good idea to mine the oceans. The Naclites are reasonable beings who, it is thought, will move on to other places if they realize that mining the oceans would kill off millions of beautiful creatures. “What’s Up” is charged with putting together a presentation that will convince the Naclites that the sea life on earth is too magnificent to be sacrificed just to satisfy their need for salt. The members decide that the presentation must have visuals, and Level I interactive video would be the best media to use.

Source: Contributed by Jack Edwards.
Three Kinds of Multimedia/Hypermedia Authoring Systems

Background on Multimedia/Hypermedia Authoring Systems

One of the most amazing things about how multimedia systems have evolved is that people with fairly nontechnical skill levels now can develop their own complex, professional-looking hypermedia products. Perhaps most importantly for schools, hypermedia authoring may play a major role in preparing students for the information-intensive and visually oriented world of the future. In tomorrow’s digital world, powerful personal computers and ubiquitous electronic networking will allow people to incorporate a variety of media into their communications. Indeed, hypermedia publishing may eventually supersede paper publishing in importance and impact. Three kinds of multimedia/hypermedia authoring tools for use by both teachers and students are described in this chapter:

- Presentation software
- Video production and editing systems
- Hypermedia authoring software.

Although these systems vary in capability and authoring procedures, all allow people to summarize and display information and knowledge using a combination of text, video, animation, music, graphics, and sound effects. The array of skills and resources that students and teachers will need in order to use any of these three categories of authoring tools are described here. In addition, integration strategies common to all of these authoring formats are discussed.

Hypermedia Authoring Resources

Over time, hypermedia programs have become increasingly more powerful and user friendly, and are adding features and capabilities with every new version released. Authors now can draw on a wide variety of resources to put a full range of sound and motion in their hypermedia products. The newest feature available in hypermedia authoring is the ability to insert Internet links into products. Users can click on these links and go immediately from software screen to Internet site. This section describes some of the other common resources available in hypermedia authoring.

Audio resources. Hypermedia authoring programs offer users a number of ways to incorporate audio clips.

- **CD audio.** Cards include segments of audio CDs in CD-ROM drives or videodisc players. CDs provide digitized music, speech, or sound effects.
- **Videodiscs.** Rather than playing both the video and audio tracks of a videodisc, authors may choose to leave the video and access the audio track alone.
- **Recorded sounds.** Hypermedia programs usually allow authors to record sound into their programs. This can include voice, such as when an author records his or her reading of a poem or directions to students.

Prerecorded sounds. Many hypermedia authoring programs come with built-in selections of sound effects. Authors can also add sounds from packaged collections sometimes called “clip sounds,” which are stored on disk or CD-ROMs.

Video resources. Motion video clips can add a whole new dimension to a program and provide authors with many new communication possibilities. As with audio, authors have several options for incorporating video displays into a product:

- **Digitized videos.** By using a video digitizer, a hypermedia author can import video images from external sources such as a VCR, a videodisc, or a camcorder. Programs such as Quicktime allow authors to create and edit their own short videoclips (movies) and place them on cards. Teachers and students need to observe copyright laws when importing video in this manner. Digitized video also consumes a great deal of hard drive storage space, thus limiting the amount of video that can realistically be incorporated into a program. An external hard drive offers one solution to this problem; removable cartridge systems are very effective in this role, although the costs for the individual cartridges can be quite high. In the future, more efficient video compression routines promise greater latitude for hypermedia authors.

- **Videodiscs.** Most hypermedia programs enable authors to access either individual slides or segments of video from videodiscs. This can prove a big advantage due to the high quality of audio and video recordings from videodiscs.

- **Prerecorded videos on CD-ROMs.** Authors can buy collections of short videoclips on CD-ROM to incorporate into hypermedia programs. No copyrights inhibit use of these images, giving authors much more leeway in their presentations.

Photographs. A picture is worth a thousand words in hypermedia, as much as elsewhere. Photographs provide a powerful resource for authors in all subject areas.

- **Scanned photos.** Authors can digitize traditional photographs using scanners and then incorporate these images into hypermedia stacks.

- **Captured from video sources.** By using a video digitizer, an author can freeze images from a VCR, camcorder, or videodisc player and then import them.

- **Digital cameras.** These cameras take digitized, color pictures that can be added to hypermedia cards. Pictures can be downloaded directly from the camera to the computer’s hard drive.

- **Imported from CD-ROMs.** Collections of photographs on CD-ROMs are marketed expressly for inclusion in hypermedia programs.
Graphic images. Graphics or drawings offer another tool for authors to communicate their ideas. Often an illustration will demonstrate a point that is difficult to get across with words. This aspect of hypermedia authoring is particularly appealing to artistically inclined users.

- Created by authors. Virtually all hypermedia programs offer basic collections of tools that let users draw or paint graphics. These tools enable users with even limited artistic talents to create credible designs and drawings.
- Imported from clip art collections. A vast array of clip art collections are available for purchase. These premade graphics cover a wide assortment of subject areas.
- Scanned images. As another alternative for accessing graphics, an image can be scanned from either a book of clip art or a drawing done in conventional art media such as pencils or paintbrushes. Since computer access often is limited, some teachers prefer students to draw their pictures by hand and then digitize them using scanners.

Animation. Animation is a highly effective tool for illustrating a concept; a student might create an animation of a seed germinating as part of a project on plants. The sources of these displays are familiar.

- Imported from CD-ROMs. Collections of animation are also available on CD-ROM. Like other media, these premade collections allow authors to rapidly add effective and professional animations to a project.
- Created using animation tools. Hypermedia programs have improved dramatically in their animation capabilities. A novice animator can now easily generate sophisticated and effective animations.

Text. In spite of the attention paid to other components of hypermedia, text still remains one of the most powerful ways of communicating ideas.

- Writing as project develops. All hypermedia programs offer standard word processing features that enable users to write text. In addition, text may also be added as a graphic item. This feature lets the user easily drag text around the screen and is handy for adding labels to pictures.
- Importing from word processing files. Most programs also let authors import text created separately in word processors. This can be a boon for an author who has saved a great deal of writing in a large collection of word processing files.

Hardware Requirements for Hypermedia Authoring

Although hypermedia authoring can be accomplished with a fairly minimal computer system, more complex products require additional hardware and software capabilities. Depending on the complexity of the product, some or all of the following hardware resources are needed.

Computer with keyboard and monitor. Hypermedia development can be done on any platform as long as the system has a hard drive and sufficient random-access memory (RAM). The minimum requirements to utilize programs like HyperStudio or Macromedia Director are much more affordable for the average classroom than they used to be.

Digital camera. Cameras like the Apple QuickTake or Sony Mavica let users take digital photographs and store them as digital files. The images can then be incorporated into hypermedia projects. Students of all ages enjoy using their own digital photographs in projects.

Scanner. If no digital camera is available, scanners can be used to digitize photos so they can be saved to a disk. Scanners also can capture still images from magazines or books.

Video digitizer. Video digitizers, also known as digitizing boards, capture full-motion video from video cameras, VCRs, videodisc players, or live TV. The video segments are then stored as computer files and can be edited using software like Adobe Premier. Both teachers and students should recognize copyright restrictions when digitizing and editing video.

Camcorders and other video input. Video cameras or camcorders, VCRs, videodiscs, or CD-ROMs are among the possible sources for motion video sequences to include in a production.

Audio card. To incorporate sound, an audio capture, playback card, and audio source such as a microphone are needed. Many computer systems sold in recent years have built-in audio cards.

CD-ROM or DVD drive. CD-ROMs and/or DVDs are essential elements in multimedia technology, and, because of their huge storage capacity, they are the only technology for storing large quantities of digitized video or audio. Hypermedia authors also can buy large collections of digitized video, audio, and still image resources on these media.

Audio speakers. To monitor quality and simply to hear the audio parts of a program, speakers are mandatory for hypermedia development. Many newer computers are shipped with either external or internal speakers.

Videodisc players. Videodiscs provide excellent resources for hypermedia authors. High-quality video or audio input can easily be accessed from any videodisc. With thousands of videodisc titles on the market and existing videodisc players in many schools, this technology will prove to be a valuable resource for years to come.

Hypermedia Authoring Procedures

Whether teachers are developing their own skills or those of their students, the hypermedia authoring process involves...
two distinct phases. Initially, authors need to learn the mechanics of the programs and develop their understanding of the concept of hypermedia. No one can develop a quality product without first being reasonably comfortable with the tools. However, at the next level, hypermedia authors must develop insights on the complexities of the various media and knowledge of visual and navigation design. This is a long-term process that will emerge through a great deal of experience. A number of strategies can aid the classroom teacher in helping students use their time efficiently and focus on developing quality products. Consider the following steps when students engage in hypermedia development:

1. **Review others’ products.** An effective way of developing authoring skills for beginners is to look at what others have done. This is particularly true with scripting. Evaluating the scripts of existing programs can give insight into how to write scripts for new projects. Through the Internet or commercial online services, teachers can download stacks. This opens up a world of low-cost or free hypermedia resources for both teachers and students. It is also helpful to examine some effective uses of media; Ken Burns’s series on the Civil War, for example, demonstrates the power of images and sound when melded together in the context of a story.

2. **Do research first.** Most hypermedia development projects require research to locate materials and data, analyze their findings, and summarize them in a format for use in the hypermedia product. It is important to allow adequate time for this research phase, for it is the heart of the learning activity.

3. **Storyboard.** Storyboarding helps students make better use of valuable computer time. On index cards or sticky notes, students can lay out what they want on each individual frame. But planning is the most difficult thing for students; they want to get right to the “fun stuff.” Most students prefer to develop only on the computer. Teachers must insist that on-paper planning be done first. It may help to explain that professional media creators practice storyboarding and that even famous movie directors such as Alfred Hitchcock and Steven Spielberg storyboarded entire movies before doing a single camera shot because it saves time in the long run.

4. **Develop individual frames.** Before adding links or graphics, students should develop each frame, including text fields.

5. **Insert graphics.** Add clip art, photos, animations, movies, and other media onto each card as needed to carry out the design.

6. **Add links and/or scripts.** Only after all the cards have been developed and decorated should links be added. Most authoring software allows a storyboard format to see most or all of the cards at one time. This and the card or sticky-note storyboards help students keep links organized among cards.

7. **Test and revise the product.** After it is drafted, students should test their products, preferably with the help of others who have not been involved in its development. The aim is to revise their products and meet criteria outlined in a later section of this chapter, Evaluating Hypermedia Products. Rembelynsky (1997–1998) offers a development sequence designed specifically for creating multimedia summaries of project-based research. She recommends students do steps in each of the following general headings: written summary, historical background, creative narrative, scanned images, video, and self-evaluation.

### Authoring Skills to Develop over Time

The beauty of hypermedia authoring is that students can create products with skills that range from basic to extraordinarily complex and sophisticated. Students may begin with “the basics” and teachers can help them move on to advanced techniques in several areas.

**Media literacy.** Given the complexities and proliferation of different media, an understanding of media basics will become a fundamental skill for the information age. Since most people will have tremendous capabilities to adapt and alter existing media in the near future, a critically important part of instruction in hypermedia authoring will focus on how to be critical and ethical producers and consumers of media (Roblyer, 1998).

**Using music and art.** Visual arts and music play major roles in the effectiveness of hypermedia products. As students gain more knowledge in the theory and aesthetics of music and art, they will use these resources more productively in the authoring process.

**Design principles.** Many principles of desktop publishing also apply to hypermedia designs. When students first see the array of graphics and sound options available, they typically overindulge and use so many colors, graphics, and sounds that content is overshadowed. Some of the design principles that can help guide more judicious use of these options are described later in this chapter in the Evaluating Hypermedia Products section.

**Creativity and novel thinking.** When assessing student projects, look for and encourage creative uses of the potential of hypermedia. Too many student projects resemble glorified paper-based projects; they do not take advantage of the true power of this medium. Classroom activities that encourage creative and critical thinking in all subject areas help develop skills and a mind-set that naturally enhances the authoring process.

**Considering audience.** Whenever possible, teachers should try to give students an opportunity to display their projects. Students will be much more motivated if they believe their work is valued. Research on writing has shown that students will invest more effort in the writing process when they know
Presentation software packages such as Microsoft’s *PowerPoint* help users create on-screen descriptions, demonstrations, and summaries of information. Presentation tools are one example of a technology that migrated from business and industry to education. These tools were first adopted by business executives and salespeople who used them to give reports at meetings and presentations to clients. Their capabilities to demonstrate, illustrate, and clarify information became evident and presentation tools began to make their way into K–12 and university classrooms.

The programs allow a user to choose from an array of text, graphics, animation, audio, and video options. Presentation tools began exclusively as “electronic slide shows,” but have evolved into multimedia authoring tools, which allow users to incorporate motion sequences from CD-ROM and other video media into their presentations.

The effectiveness of a presentation tool depends largely on the communications skills of the presenter. For large classes and other groups, presentation software products usually are used in conjunction with computer projection systems. These may be devices such as LCD panels that fit on top of overhead projectors or systems that operate as stand-alone devices. All of these devices enlarge the image produced by the software by projecting it from a computer screen onto a wall screen.

While presentation software makes it possible for students and teachers to communicate in the “grammar of multimedia,” new users make some common “grammatical mistakes.” Ten of the most common errors made by users of presentation software are described in InSight 7.1.

### Characteristics of presentation software

These packages were originally designed to display in a linear sequence and, even though they now offer branching by allowing authors to include clickable buttons or “hot spots,” many materials produced with presentation software retain this linear characteristic. Presentation software also allows authors to include graphics of all kinds, audio and video clips, and Internet links.

### Presentation software packages

By far the most commonly used presentation software is Microsoft’s *PowerPoint*. (See Figure 7.6.) However, other packages such as *KidPix* and presentation options within integrated productivity packages such as *AppleWorks* also offer similar “slide show” capabilities.

### Authoring Tools Type 2: Video Production and Editing Systems

Once the exclusive domain of Hollywood, movies and video sequences are now a growing presence in school activities. Students and teachers are using computer-based video production and editing systems for a variety of pur-
poses ranging from presenting the daily school news to teaching sophisticated video production skills.

**Characteristics of Video Systems.** Video editing systems are to motion images what word processing is to text. The next decade likely will see an explosion in video editing and production to rival the rapid increase in word processing of documents. As Howard (2001) observed, video software can be very time consuming for anyone who wants to do high-quality videos, and especially so for novice users. However, schools across the country are beginning to use these systems to produce school news programs and to develop digitized video for use in authoring hypermedia products (Hoffenburg & Handler, 2001).

The main purpose of these software systems is to take video into a computer from a source such as a camcorder and change it into digital format (AVI or MPEG files), which allows it to be edited and combined with special effects such as titles, screen fades, and voice-over audio. It also allows the resulting digitized video clips to be inserted in a multimedia package or uploaded to the Internet. An example of a movie frame in a video editing screen is shown in Figure 7.7. At the bottom of the figure are two tracks, audio and video. By sliding markers on these tracks, students can cut, copy, and/or paste sections of a video and/or combine them with special effects such as fades or background music.

**Current Video Editing Software Packages.** When Apple Computer included a free copy of its video production software *iMovie* with some of its computer systems, it heralded the beginning of widespread interest in video editing among educators and other consumers. In addition to *iMovie*, popular editing software also includes the following:

- **Adobe Premiere** (Adobe)
- **Avid Xpress** (AVID Technology)
- **EditStudio** (Pure Motion)
- **Final Cut Pro** (Apple, Inc.)
- **Cute Video** (Litora, Inc.).

Joss (2001) also recommends several other hardware and software options for video production.

**Authoring Tools Type 3: Hypermedia Software**

**Characteristics of Hypermedia Authoring Software.** In the late 1980s, early hypermedia authoring programs included *HyperCard* for Macintosh, *LinkWay* for MS-DOS machines, and *TutorTech* for Apple II. These programs represented a major jump forward in technology, but because authors had to make major time commitments to learn and use the software, their use was limited. Things began to change when Roger Wagner’s *HyperStudio* was released. This program used the same basic “card and stack” metaphor as *HyperCard* but eliminated much of the need for extensive scripting or for programming commands. In recent years, a number of programs have become available that emulate *HyperStudio*’s easy-to-use format. As computer power increases and becomes more affordable, even more sophisticated and easy-to-use programs than the ones described here have become available.
However, teachers also can choose simpler products such as Broderbund’s KidPix or the slideshow option in AppleWorks.

A trend in multimedia software is toward increasingly higher end, more capable software such as Macromedia Authorware. Also, many multimedia packages (e.g., Macromedia Director Shockwave Studio) are moving toward including web page authoring and 3D production. Use of these latter packages in education is limited, but they are seeing increasing integration into high school technology education programs.

Current Hypermedia Authoring Software. Most classroom-based multimedia/hypermedia authoring is done with software such as the following:

- **HyperStudio (Roger Wagner, Inc.).** One of the most innovative products on the market for Mac and Windows computers, this product (See Figure 7.8) has developed a large following among teachers. It remains the most used multimedia authoring system in education.
- **MicroWorlds Project Builder (LCSI).** The unique emphasis on Logo gives users experience at simple programming. Separate packages are also sold as Math Project Builder and Language Arts Project Builder.
- **Multimedia Toolbook (Asymetrix).** This Windows program features video editing software, support for many file formats, and a Media Packager that gathers and compresses multimedia elements for a given product.
- **Digital Chisel (Pierian Spring Software).** A powerful product for Macintosh, this program supports full text-to-speech capability and includes question templates for developing tests.
- **Macromedia Authorware.** This authoring package has features ranging from animations to streaming video.
- **Macromedia Director.** This very capable and complex full-featured system is for developing multimedia products and includes video.
- **Mpower (Tom Snyder).** This is one of the newer authoring packages and emphasizes ease of use and ready-to-use materials for inexperienced developers.

Integration Strategies for Hypermedia Authoring

Multimedia and hypermedia development projects are taking the place of many traditional activities to accomplish
the same purposes. Some common classroom applications of multimedia and hypermedia are described here.

- **Electronic portfolios.** Student portfolios have become more common for assessment purposes, and multimedia/hypermedia have assumed a central role in portfolio development. Many teachers also are required to develop portfolios to document their teaching methods in preparation for promotion or additional certification. Portfolios are being done on all three of the multimedia/hypermedia formats described here (presentation software, video systems, and multimedia/hypermedia authoring software), although web-based portfolios also are becoming increasingly popular. (See InSight 3.12 in Chapter 3.) Many authoring programs such as HyperStudio include player files that run program files without the application itself. This is particularly useful when a student wants to take a project home and run it on the family computer or take it to a college or job interview.

- **Multimedia slideshows.** Although slideshow projects frequently call for presentations that are linear in format, they can be useful to help younger students develop beginning multimedia creation skills, since the focus is on the basic skills of writing text and screen design. Monahan and Susong (1996) describe how students developed simple slideshows to display their findings on wildlife. Harrison (1998–1999) describes other instructional uses of presentation software across the curriculum, and Brown (1998) describes effective uses of presentation software in a one-computer classroom.

- **Slideshow reviews and drills.** Many teachers report a simple, but highly effective use of PowerPoint and other presentation software. They set up a computer in the classroom to display automatically advancing frames of spelling words, vocabulary words, math facts, and information such as daily announcements. According to teachers who have used these strategies, students seem to attend to and retain much of what they see on these slideshows.

- **Tutorials.** Both teachers and students can create multimedia instructional sequences that step the user through the components of a subject. Figure 7.9 shows two cards from a HyperStudio tutorial on the instruments in an orchestra. In this product, the user may click on an instrument to hear it play and to read more about it.

- **Book reports.** Instead of presenting book reports verbally or as written summaries, it is becoming increasingly common for students to report on their reading through multimedia slideshows or as hypermedia products. Teachers often design a standard format or template, and students fill in the required information and add their own illustrations.

- **Research presentations.** Scholten and Whitmer (1996), Bennett and Diener (1997), and Stuhlmann (1997) point out that hypermedia presentations not only let students present their findings attractively and with impact, the act of producing and sharing what they have learned also helps students learn even more about the topics and enhance their research, study, and communication skills.

- **Created tours.** Hypermedia products are an effective way to document field trips because they let others take virtual “trips” to the locations.

- **Interactive storybooks.** Fredrickson (1997) describes a use that builds on the book report purpose. Students document existing stories or write their own so they can be read interactively by others. Those reading these hypermedia stories can click on various places on the screen to hear or see parts of a story. This format also lets students go beyond one basic sequence and create their own branches and endings to stories.

- **School yearbooks.** Although still a relative novelty, more and more schools are developing their yearbooks as hypermedia products (Kwajewski, 1997).

- **School news reports and announcements.** Many middle and secondary schools are beginning to use video cameras and video editing software to produce a

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**Figure 7.9 HyperStudio Stack: The Sections of the Orchestra by Jolaine Sims**

![HyperStudio Stack: The Sections of the Orchestra by Jolaine Sims](source: Used with permission from Jolaine Sims.)
daily news show. These productions “star” the students themselves, and students also do the camera and editing work. New shows offer valuable opportunities to help students develop their on-camera presentation skills, as well as their technical production skills.

Procedures for Implementing Hypermedia Authoring

Like most technology resources, the impact of multimedia systems will depend heavily on how well teachers integrate them into classroom activities. Blissett and Atkins (1993) suggest that the following points are important for teachers to keep in mind when integrating interactive multimedia into the classroom:

- Provide guidance and further explanation on the nature of the task when a group gets stuck or, worse, misunderstands what to do.
- Check that the software package provides advance organizers for its conceptual content.
- Individualize the learning experience by assessing learning as it occurs and then intervening to link and relate or extend and consolidate concepts to meet the needs of particular pupils or groups.
- Ask open-ended questions that require pupils to verbalize their thought processes and review their understanding of the conceptual subject matter.
- Challenge and provoke thinking, leading to more abstract and conceptual discussions.
- Help the group to review its problem-solving strategies and direct them toward more powerful ones.
- Before assigning hypermedia projects, do training in group-work skills.

As Blissett and Adkins point out, teachers must prepare students well for hypermedia authoring activities by teaching them the technical skills they need and by setting well-defined parameters for the project. This is especially true for younger students and for all students doing such projects for the first time. Technology Integration Ideas 7.5 through 7.9 illustrate some of the many current uses for multimedia/hypermedia authoring resources ranging from PowerPoint to Macromedia Director.

Evaluating Hypermedia Products

Evaluating Commercial Hypermedia Products

To derive criteria to use in evaluating multimedia software, Gibbs, Graves, and Bernas (2000) used Delphi surveys of a panel of instructional technology experts. Perhaps not surprisingly, the list of criteria (see Appendix Figure A.7) emphasizes the instructional and pedagogical aspects of the products rather than their multimedia characteristics. The result is a list similar to that found in Chapter 4 for instructional software.

Evaluating Student-Developed Hypermedia

Dipinto and Turner (1995) suggest that student self-assessment of hypermedia projects may be the most important component of the assessment process, saying that perhaps it enables students to construct a microworld where assessment becomes a feedback mechanism, leading to further exploration and collaboration (p. 11). Several authors have developed criteria and rubrics for assessing the quality of students’ hypermedia products. Litchfield (1995), Brunner (1996), and Clark (1996) describe qualities to look for in effective products. These are summarized in Appendix Figure A.8.

Hypermedia Projects with Electronic Encyclopedias and PowerPoint

TITLE: Selling a Space Mission

CONTENT AREA/TOPI: History/science

GRADE LEVEL: Middle school

NETS FOR STUDENTS: Standards 1, 3, 4, 5

DESCRIPTION: This activity asks students to design, write, edit, and publish a brochure and prepare a PowerPoint presentation to “sell” a space research project. Students pair up into space mission planning teams. Each team conceptualizes a mission that would accomplish both scientific and social goals that the public could enthusiastically support, with the right encouragement. Then students “sell” their space mission. The teacher uses the Microsoft Encarta encyclopedia or another such resource, along with an overhead projection device or large monitor, to take a journey through the history of space exploration, from the Sputnik days of the 1960s through the Apollo moon mission, the Challenger disaster, and to the recent remote-robot exploration of Mars. When students design their brochure, they can paste in pictures from the encyclopedia to illustrate their slides.

Source: Based on a lesson from Microsoft Productivity in the Classroom. Copyright 1997 by the Microsoft Corporation.
### Hypermedia Authoring Software—KidPix Slideshows with Video

**TITLE:** Using *QuickTime* movies and *KidPix* in an Animal Alphabet Project  
**CONTENT AREA/TOPIC:** Prereading skills  
**GRADE LEVEL:** Kindergarten and first  
**NETS FOR STUDENTS:** Standards 1, 3, 4, 5  
**DESCRIPTION:** Students combine digital photos, *QuickTime* videos, and text in *KidPix* to prepare multimedia presentations on the alphabet. During the year, students learn the letters of the alphabet by matching letters to animal names, and then learn the American sign language hand sign for the sounds. They make clay models of their animals, and the teacher makes digital photos of the animal models. With the teacher’s help, students open their pictures in *KidPix* and stamp the initial letter of the animal around the picture. Finally, teachers videotape students naming the letters, their initial sounds, and the related sign language hand signs for that letter. The videos are made into *QuickTime* videos and inserted into the *KidPix* frames to complete the product: a *KidPix* slide show.


### Hypermedia Authoring Software—QuickTime Video

**TITLE:** Using *QuickTime* Movies in a Monarch Butterfly Project  
**CONTENT AREA/TOPIC:** Science/biology  
**GRADE LEVEL:** Elementary  
**NETS FOR STUDENTS:** Standards 1, 3, 4, 5  
**DESCRIPTION:** After visiting several Internet sites to learn more about Monarch butterflies, children videotape the development of the butterfly as it goes through the four stages of metamorphosis. The resulting movies are placed on a web page to share with other classes.


### Hypermedia Authoring Software—HyperStudio Stacks

**TITLE:** A Student Autobiography  
**CONTENT AREA/TOPIC:** Writing/language arts  
**GRADE LEVEL:** Fifth through eighth  
**NETS FOR STUDENTS:** Standards 1, 3, 4, 5  
**DESCRIPTION:** This activity begins with students researching their family backgrounds. This activity should employ a questionnaire that students help generate. They take home the questionnaire and get help from relatives with filling out details of their lives. The teacher may suggest or require that the projects contain some or all of the following information:

- Events that happened the year they were born; these may be drawn from newspapers, almanacs, magazines, or parents’ recollections
- Their interests and hobbies
- Information about the town where they were born
- Family tree diagrams
- Top 10 lists, including books, foods, movies, songs, people, and sports teams
- Scanned-in photos.

Students use an authoring software like *HyperStudio* to develop their products. The project culminates with an open house for relatives to view the autobiographies.

*Source: Contributed by Jack Edwards.*
Hypermedia Authoring with High-End Authoring Systems

TITLE: Quilting Our History

CONTENT AREA/TOPIC: U.S. history and multimedia design

GRADE LEVEL: High school

NETS FOR STUDENTS: Standards 1, 3, 4, 5

DESCRIPTION: Students develop high-end multimedia design skills as they create a CD-ROM “quilt” that describes local history.

This schoolwide project required a great deal of planning and collaboration among teachers in several content areas, but the basic goal was to document the history of the local area and the families whose personal histories were intertwined with the history of the region. After all the content area teachers worked together to decide on the project design and how it would be carried out, students formed teams to accomplish the production tasks: researching information about the history of the local region and the families, geometric design of quilted squares to represent various families, gathering video documentation, and multimedia design. This project used a high-end multimedia software (Macromedia Director) along with Adobe Photoshop and 3D and audio packages. The technology education classes carried out the actual multimedia design and production.


Exercises

Record and apply what you have learned.

Self-Test

To review terms and concepts in this chapter, take the Chapter 7 self-test. Select Chapter 7 from the front page of the Companion Website (http://www.prenhall.com/roblyer), then choose the Multiple Choice module.

Portfolio Activities

The following activities address ISTE National Educational Technology Standards for Teachers (NETS-T) and will help you add to your professional portfolio. To complete these activities online and save or submit the materials electronically, select Chapter 7 from the front page of the Companion Website (http://www.prenhall.com/roblyer), then choose the Portfolio module.

1. Defining Multimedia and Hypermedia (NETS-T Standards: I-B, V-A) Use a presentation software to develop a chart, diagram, or other graphic presentation that compares and contrasts multimedia and hypermedia. List or describe the defining qualities they share and those that make them different from each other.

2. Hypermedia Professional Self-Description (NETS-T Standard: V-A) Use a hypermedia authoring program (any of the three types) to develop a presentation that introduces your professional background, skills, and plans for the future. Use storyboards or sticky notes to storyboard the design and layout for your presentation. Review your product and make sure it meets the criteria given in this chapter.

Questions for Thought and Discussion

These questions may be used for small group or class discussion or may be subjects for individual or group activities. To take part in these discussions online, select Chapter 7 from the front page of the Companion Website (http://www.prenhall.com/roblyer), then choose the Message Board module.

1. Mergendollar (1997) said that multimedia environments are an “equivocal blessing” because they give us a bounty of information without indicators of its quality, accuracy, or usefulness. What are the possible consequences to education of our increasing wealth of unevaluated multimedia information?

2. Boyle (1997) said that, “Multimedia learning is not something new. It is woven into the fabric of our childhood” (p. ix). What do you think Boyle meant by that, and what implications might his observation have for enhancing children’s learning experiences?

Collaborative Activities

The following activities address ISTE National Educational Technology Standards for Teachers (NETS-T) and may be developed in small group work. Completed group products may be copied and shared with the entire class and/or included in each person’s personal portfolio. Remember that most hypermedia authoring systems provide a free player that can play these student-produced products.

1. Create a Level I Presentation (NETS-T Standards: I-B; II-C, D; IV-A; V-A) Use a videodisc to design and present a
persuasive presentation. The topic will depend on the disc; examples include:

**Drug and tobacco use:** Teenagers should not start smoking.

**Solar system/space travel:** The U.S. government should expand its space program.

**American history:** The United States should/should not have dropped the bomb on Hiroshima.

2. **Develop a Hypermedia Teaching System (NETS-T Standards: I-B; II-C, D; IV-A; V-A)**

The class divides into small groups to create a hypermedia instructional product to teach others about hypermedia authoring. Each group takes a topic and the class puts the products together at the end. For example, groups may select one of the following topics:

- What topics lend themselves to hypermedia? Ideas and examples
- An overview of the components of a hypermedia product
- A review of development steps
- A review of effective screen design procedures
- How to add graphic images, movies, animation, and videoclips
- Criteria and strategies to use when assessing hypermedia products.


Using the integration ideas in this chapter as models and idea sources, develop a classroom integration lesson plan to teach content area skills using one of the following resources:

- CD-ROM or DVD encyclopedia, almanac, or atlas reference materials
- Level I videodisc curriculum package
- Presentation software such as *PowerPoint*
- Video production and editing software
- Hypermedia authoring system such as *HyperStudio.*

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**Integrating Technology Across the Curriculum Activities**

The *Integrating Technology Across the Curriculum* CD-ROM is a set of technology integration ideas and links to online lessons, arranged as a searchable database. The CD comes packaged with this textbook. Complete the following exercise using this CD.

What role can multimedia/hypermedia play in your own content area? Select a content area and locate a technology integration idea for each of the five types of multimedia/hypermedia. Make a chart listing the types and the integration ideas.

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**References**


Figure A.7  Criteria for Evaluating Commercial Multimedia Software Products

Instructional planning. Target audience and prerequisite skills are specified.

Support. Computer hardware and software requirements are specified.

Instructional adequacy. Instructional objectives are clearly stated. Practice activities are provided that actively involve the learner. Instructional activities needed to complete learning tasks are made explicit.

Information content. Information is current and accurately represents the topic. Examples, practice exercises, and feedback are meaningful and relevant.

Information reliability. Information is accurate, that is presented in a truthful, valid way.

Clear, concise, and unbiased language. Courseware content (text, pictorial, graphical, auditory, and video information) is presented clearly.

Interface design and navigation. Courseware screen elements (titles, text areas, navigation buttons, etc.) are easy to understand. Directions are understandable.

Feedback and interactivity. If tests are present, they are matched to objectives. Feedback is appropriate to content, learning tasks, learner response, and learning environment.

Evidence of effectiveness. During student uses of courseware, there is evidence of learning/performance gains. The courseware supplies information to teachers and students on how it measures student learning.

Source: Based on Gibbs, Graves, and Bernas, 2000, p. 102.
## Appendix

**Figure A.8  Criteria for Evaluating Students’ Multimedia Projects**

<table>
<thead>
<tr>
<th>Language</th>
<th>No ethnic, slang, or rude names; content presented in a professional way</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Correct spelling, punctuation, and grammar</td>
</tr>
<tr>
<td></td>
<td>No questionable vocabulary, slang terms, or curse words</td>
</tr>
<tr>
<td>Type and Font</td>
<td>Controlled use of fonts and type sizes (no more than 2–3 in product)</td>
</tr>
<tr>
<td></td>
<td>Type large enough to read when projected</td>
</tr>
<tr>
<td></td>
<td>Color contrasts with background for easy reading</td>
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<tr>
<td></td>
<td>Bold or plain for writing main text; avoid shadow and outline for more than a few words</td>
</tr>
<tr>
<td></td>
<td>Have only brief main ideas in each frame; do not have paragraphs of text; save explanations for your presentation</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Graphics, Visuals, and Sound</th>
<th>Content includes text, graphics, visuals, and sound; each frame contains text and graphics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Graphics, visuals, and sound are appropriate to the topic, add to your project, and help communicate the information relevant to the topic</td>
</tr>
<tr>
<td></td>
<td>No obscene or rude graphics or visuals</td>
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<tr>
<td></td>
<td>Controlled, nondistracting use of screen changes such as wipes, zooms, and fades</td>
</tr>
<tr>
<td></td>
<td>Buttons on each card; each works as indicated</td>
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<tr>
<td></td>
<td>Pictures and sounds associated with buttons are appropriate to purpose and content of the card(s)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Content</th>
<th>All information is current</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All information is factually accurate</td>
</tr>
</tbody>
</table>

Source: Based on Litchfield, 1995; Brunner, 1996; and Clark, 1996.