HYPERMEDIA COMPUTER-BASED EDUCATION IN SOCIAL WORK EDUCATION

DAVID A. PATTERSON AND JOANNE YAFFE

Hypermedia computer-based education (CBE) is an emerging information technology that makes possible user-directed, nonsequential exploration of, and interaction with, information presented through a variety of media including text, animation, graphics, sound, and video. This article describes hypermedia CBE and briefly reviews the research on its instructional efficacy. A synopsis of the theoretical foundation covers cognitive theory concepts of information networks and associative learning, web teaching principles, andragogical theory as it relates to social work education, and hypermedia CBE structure. Examples of current and potential applications in social work education demonstrate that hypermedia CBE can emulate the dynamic, iterative learning process of knowledge acquisition, knowledge testing, and content integration through practice simulation.

THE CONVEYANCE of the social work knowledge base is a multifaceted task in social work education. Information is transferred in the classroom, through texts, among peers, and in field placements. In recent years, computer-based education (CBE) has assumed a small role in the dissemination of information within social work education (Collins, Oberg, & Shera, 1988; Green, 1988; Hansen, 1981; Hudson, 1985; Lynett, 1988; Patterson, 1991; Patterson & Yaffe, 1993; Reinoehl & Shapiro, 1986; Seabury & Maple, 1993). The educational capacity of today's computer technology far exceeds what was available only five years ago. Recent advances in software and hardware present dramatic opportunities to reconceptualize the manner in which adult learners can access and interact with information and thereby acquire social work knowledge. Hypermedia is a powerful emerging computer-based information technology with the potential to alter dramatically the educational process (Begoray, 1990; Kozma, 1991; Slotnick, 1990).

The purpose of this article is to introduce social work educators and administrators to current and potential uses of hypermedia in social work education. Specifically, it (a) describes hypermedia software, (b) presents a brief review of related empirical research, (c) reviews the theoretical underpinnings of educational hypermedia, and (d) discusses its application, integration, and potential costs. This discussion is intended to stimulate both the development of applications of hypermedia CBE across the social work curriculum and research on its utility, efficacy, and cost effectiveness.

DAVID A. PATTERSON is assistant professor, University of Tennessee, and JOANNE YAFFE is associate professor, University of Utah.

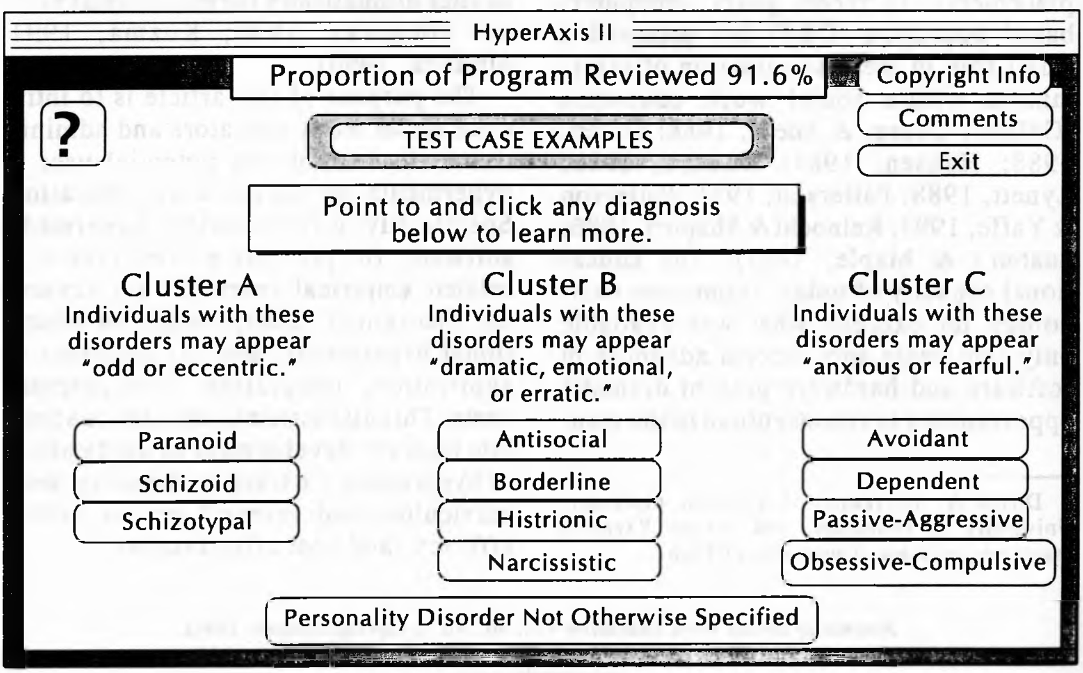
Journal of Social Work Education Vol. 30, No. 2 (Spring/Summer 1994).

Hypertext/Hypermedia

Hypermedia is derived from the term *hypertext*, which refers to the access of computerized information in a nonsequential or nonlinear manner. *Hypertext* was coined by Ted Nelson (1974), who proposed the creation of large computer networks in which users could access information based on their individual informational needs, rather than through a predetermined, and generally less efficient, linear structure. CBE programs historically have presented information to users in a sequential manner that does not allow free exploration of the knowledge base. Moreover, traditional CBE programs have presented information in text format only and done little to gain, hold, or facilitate users' interaction with educational material (Jaffe & Lynch, 1989). The term hypermedia refers to computer-based, user-directed, nonsequential access to information presented through the integration of two or more media, for example, text, animation, graphics, sound, and video. Users can explore these rich and responsive hypermedia programs in a manner that matches their individual curiosities or informational needs.

Hypermedia software can be created via object-oriented programming languages. Object-oriented programs allow individuals with little or no programming experience to use objects such as buttons, fields, and pages or cards (individual screens) to construct hypermedia programs. Figure 1 shows a screen created by the senior author for HyperAxis II (Patterson, 1993), a program designed to train students and clinicians in the use of DSM-III-R Axis II (American Psychiatric Association, 1987). Each diagnosis in the program is represented by a button that, when activated by a mouse, presents the user with a series of screens containing relevant information. The screen in Fig-

Figure 1. Personality Disorder Selection Screen for HyperAxis II



ure 1 also contains fields that hold information (e.g., *Point to and click any diagnosis below to learn more*) and display data (e.g., *Proportion of Program Reviewed*).

The creation of buttons, fields, and screens in most object-oriented programs does not require elaborate or complex sequences of computer program language. Instead, simple menu-based commands produce buttons and fields that can be placed at any location on the screen as the user interface is designed. In most object-oriented programs (e.g., HyperCard, Toolbook), buttons and fields are labeled with words or short instructions. Sound, graphics, video, and animation can supplement the screen display to enhance the interactive, engaging, and information-transmitting qualities of the hypermedia program.

Hypermedia/Hypertext Research

Nielsen (1990) reviewed the limited literature comparing hypertext CBE to traditional CBE programs and text-based education. He concluded that the utility of hypertext CBE is dependent on its purpose, the hardware and software, the program design, and the characteristics of the program users. The research cited by Nielsen, however, concerned only hypertext programs that did not integrate sound, graphics, animation, or video, all of which may engage user cognitive domains not tapped by text-only materials (Kozma, 1991).

Van den Berg and Watt (1991) tested the effectiveness and student acceptance of a structured hypertext program designed to teach statistics and hypothesis testing in an introductory research class. The program was tested over three semesters in three randomly assigned experimental conditions: (a) with a subset of students from a class who used the program to learn the material for six weeks while not attending class; (b) with students who used the program to supplement class lectures; and (c) with a separate group of students for whom the program replaced the class. A control group attending the lectures was evaluated on the same dimensions as the experimental groups. The authors reported no significant differences in class performance between the experimental and control groups. Students who used the program as a supplement for classroom lectures had the most strongly positive attitude toward the program. The authors concluded that in some situations structured hypertext can serve as a cost-effective alternative to in-person instruction.

In the first test of hypermedia in social work education, Patterson and Yaffe (1993) used an experimental design to compare the educational effectiveness of a hypermedia program (HyperAxis II) to a training manual teaching DSM-III-R Axis II diagnostic skills to graduate social work students. They found HyperAxis II to be as effective as the training manual in increasing diagnostic speed and accuracy. Moreover, students using HyperAxis II expressed a stronger liking for the program as an educational medium than the control group did for the training manual.

Lanza and Roselli (1991) tested the instructional utility of two types of CBE programs in teaching a computer language. One program presented the content in a structured approach that allowed users to move through the material only in a linear manner. The other was a hypertext program that allowed users to explore the same content in a nonlinear, self-directed manner. The researchers found no significant difference between the two groups on performance outcome. They did find, however, greater variability in the scores of the hypertext group, and consequently suggested that their study has implications for using hypertext materials with more motivated and self-directed students.

As hypertext or hypermedia CBE has not yet been proved educationally superior to text-based or traditional CBE programs, a rationale for the development of social work CBE hypermedia is necessary. Patterson & Yaffe (1993) have argued that hypermedia CBE, unlike text-based materials, is readily modifiable, is electronically transportable via modems over phone lines or on disks, is available to multiple users on computer networks, and can provide immediate feedback to users, nonlinear information exploration, and automated data collection. The paucity of research cited here suggests the need for more extensive testing of the educational potential of hypermedia. Toward that end, Nielsen's (1990) equivocations about the effectiveness of hypertext programs must be addressed in the development and testing of future hypermedia programs. Their development will be assisted by an exploration of the theoretical foundation of educational hypermedia, along with a clear delineation of educational objectives and specification of intended users.

Theoretical Underpinnings

The following summary of the theoretical basis of educational hypermedia covers (a) cognitive theory, (b) web learning/instructional theory, (c) andragogy, and (d) hypermedia CBE structure. This theoretical synthesis is a multidimensional, interdisciplinary model for the development of hypermedia software in social work education.

Cognitive Knowledge Representation

The concept of a hypertext-like system of informational management is credited to Vannevar Bush, President Franklin Roosevelt's Science Advisor (Tsai, 1988). In the 1940s, Bush predicted the virtual explosion of information that has occurred in the last half of this century, and proposed the creation of a machine called memex that allowed for the linkage of documents stored on microfilm. Bush conceptualized that the operation of the human mind was based on "omni-directional association" (Tsai, 1988, p. 4). Memex was to be designed to maximize the potential for user-defined, associative information retrieval that mirrored Bush's conception of cognitive processes.

Bush's conceptualizations of cognition are supported by current theories of knowledge representation (Jonassen, 1986). One significant theory is that information is stored in networks composed of nodes and associative connections (Bobrow & Norman, 1975). The nodes, which can represent ideas, concepts, or bits of information, are linked by the associative connections. Learning is seen as the process of acquiring new nodes linked to informational networks already existing in the learner (Jonassen, 1986). Comprehension is enhanced when the number of associative links from the existing informational network to the new nodes are maximized. Moreover, these networks are used by the individual to interpret and comprehend new stimuli/information.

These informational networks can be diagrammatically represented as "webs of information" (Jonassen, 1986, p. 275). Theoretically, integration of new learning occurs with the linkage of novel information to associated nodes. Webs increase in size as greater informational detail is woven into the existing structure.

Instructional Principles

Out of these web learning concepts, web teaching principles have been derived (Jonassen, 1986; Norman, 1973). When presenting new information, teachers first provide an outline, intended to be associated with prior learning. This structure is then elaborated with increasing detail in an overview of the material to be taught. The final step in teaching is the provision of detail in the substructure of the informational web or hierarchy.

Reigeluth (1983) has proposed an elaboration theory of instruction, conceptually derived from web teaching principles. Elaboration theory proposes that instruction should be a process of moving from simple to complex, allowing for the establishment of a strong contextual base on which to build detail and conceptual linkage. In his model, Reigeluth emphasizes learner control over selection and exploration of the components of the outlined material that are of greatest personal interest. He uses the metaphor of the learner "zooming in" for detailed information in areas of interest. As will be demonstrated below, hypermedia CBE programs can be designed to model the cognitive principles reviewed above.

Andragogy

The notion of learner control is central to andragogical theory. The term *andragogy* originally referred to methods and processes for educating adult learners, in contrast to pedagogy, the art and science of educating children (Cartor, 1990). More recently, the criterion of age to distinguish between andragogical and pedagogical educational practices has been de-emphasized as the focus has shifted to learner characteristics.

Knowles (1980) has identified four basic andragogical assumptions about learners. First, the learner is self-directed and independent in his or her pursuit of information. Second, the learner's life experience should be acknowledged, emphasized, and built upon. Third, the learner comes with a readiness to learn that is driven by his/her social and occupational roles; the educational emphasis is on problems, not subjects. Finally, the learner is motivated by the potential for immediate application of skills and knowledge.

Andragogical assumptions about learner characteristics are consistent with the social work education model that promotes student integration of theory and practice through field placements. Assuming that social work students, especially those at the graduate level, tend to have characteristics consistent with andragogical theory, then hypermedia software, which theoretically maximizes user-directed exploration, should represent a powerful means for student learning. In hypermedia, individual learners are able to engage the material in a self-directed manner, build upon their existing knowledge structure, ignore redundant information, interact with the information on a need-to-know basis, and, as will be discussed below, test their acquisition of skills and knowledge.

Hypermedia CBE Structure

Nelson (1978) has posited that four intrinsic capacities make computers uniquely adaptable to presenting knowledge in a hypermedia structure. First, they can present information in a variety of forms including graphics, animation, audio, video, and text in an array of fonts. Second, their informational databases can instantly gratify the learner's desire for information. Third, dependent on the program structure, they can link the learner from any location in the database to any other location, thereby facilitating a high degree of learner control that is well suited to the idiosyncratic *a priori* information structure the learner brings to the new information in the database. Finally, hypermedia can be presented on computers that allow for "windowing" between subject areas.

For example, a student exploring information about Erikson's stages of human psychological development can open a window to the theories of Piaget, Maslow, or Kegan (Mahoney, 1991), and within that window read, hear, or see information about the work of these theorists. The richness of the student's exploration of a given developmental stage can be further enhanced by viewing film clips demonstrating key features of that stage. Having drawn his or her own comparisons and contrasts between the theories, the student can close the window and continue exploring Erikson's work. Hypermedia CBE programs are unequaled in their ability to provide for such individualized learning.

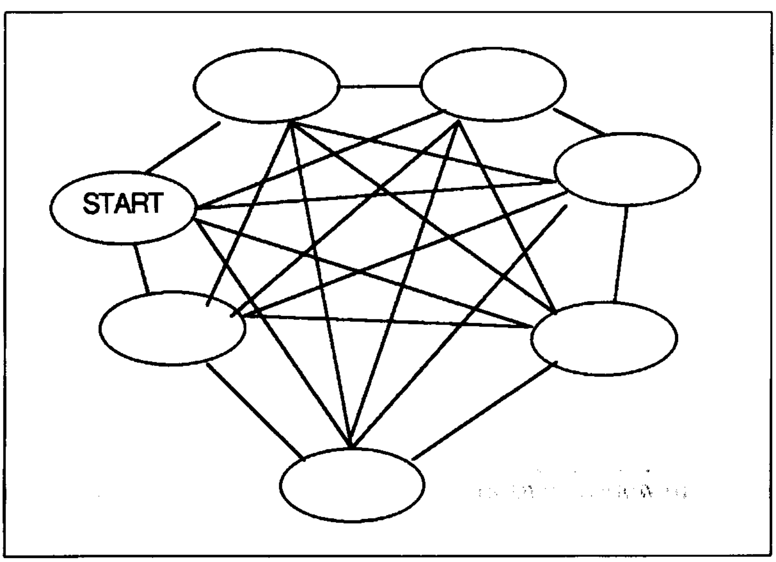
The design flexibility of hypermedia allows for CBE programs to be constructed with three basic formats: (a) node-linked hypermedia, (b) structured hypermedia, and (c) hierarchical hypermedia (Jonassen, 1986). In a node-linked format, information in any node can be accessed from any other node. This extreme accessibility allows users to move through the knowledge base in a controlled and idiosyncratic fashion. Figure 2 illustrates the multiple options for exploring a node-linked hypermedia structure.

One drawback of such a structure is the potential for users to become disoriented or "lost in hyperspace" (Edwards & Hardman, 1989, p. 105). The authors of Apple's HyperCard program have attempted to address this problem by creating a menu-accessed screen showing the last 42 cards a user has viewed (Goodman, 1988). By going to this screen (card), users can select an icon that will return them immediately to a familiar location in the program. Other programs include help screens with structural diagrams of the program; users can employ the diagram as a map.

Structured hypermedia, the second format, represents an attempt to present conceptually consistent information more systematically, while still allowing for exploration of related concepts. Nodes of related ideas are presented in groups or sets. These sets of nodes are linked to other sets, as shown in Figure 3. Structured hypermedia is a means to impose order on the potentially chaotic and meaningless information access available in node-linked systems.

In the third format, hierarchical hypermedia, nodes of general concepts lead to nodes of related and increasingly detailed information, as illustrated in Figure 4. The structure is analogous not only

Figure 2. Node-Linked Hypermedia Structure



to the cognitive informational networks described above but to fractal structures as well.

Fractal geometry is the study of the mathematics underlying naturalistic structures on both a macro and micro level, for example, coastlines and neurons (Gleick, 1987; Goldberger, Rigney, & West, 1990). The seemingly chaotic patterns of blood vessels dissecting the heart, neural structures in the brain, and bronchial paths in the lungs have an underlying order. These fractal structures exhibit self-similarity across levels of magnification. Moreover, they are thought to develop in response to the laws of nonlinear dynamics in a man-

Figure 3. Structured Hypermedia System

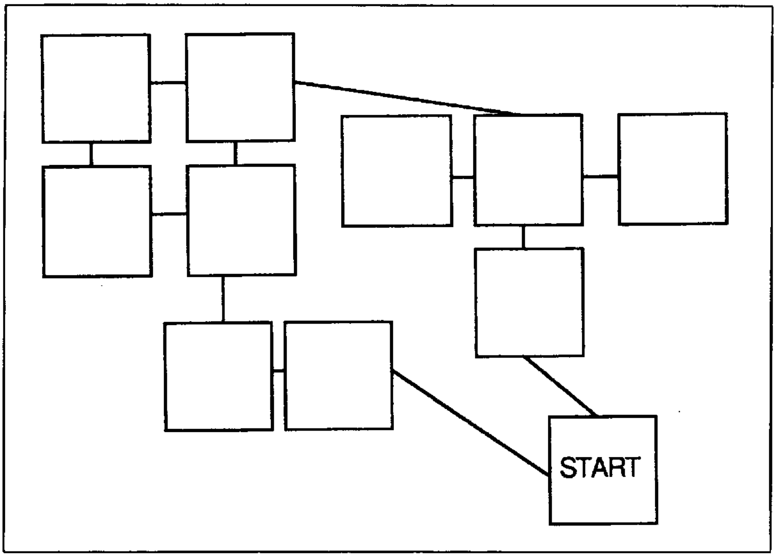
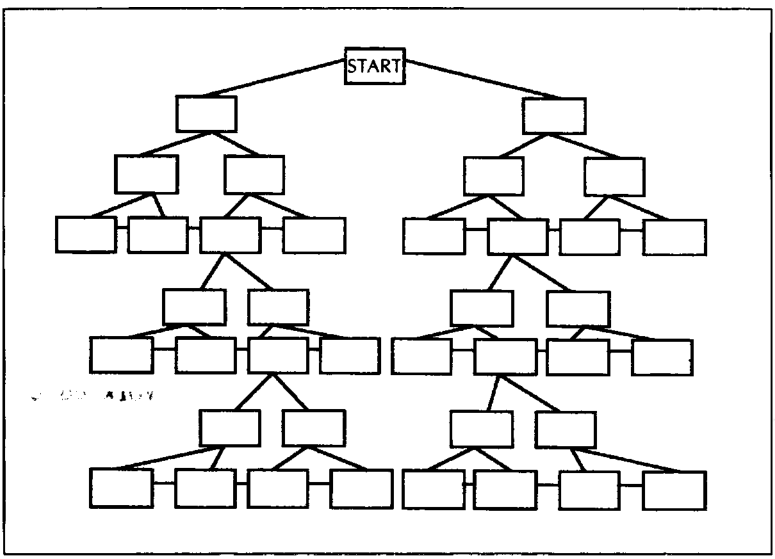


Figure 4. Hierarchical Hypermedia Structure



Note. Figures 2, 3, and 4 have been adapted from Jonassen, 1986.

ner that maximizes the transmission of information or nutrients. Because hierarchical hypermedia programs are thought to model the organic geometry of information transmission, they may represent the ideal paradigm on which to base the construction of CBE programs (Tsai, 1988).

Applications of Hypermedia to Social Work Education

Social work education can be conceptualized as an iterative process in which the learner's education advances via moves between knowledge acquisition in the classroom and knowledge testing and integration in the field placement. This dynamic of knowledge acquisition, knowledge testing, and integration, in which the limits of a student's knowledge are exposed in interaction with the occupational environment, can be simulated in hypermedia software.

In HyperAxis II (Patterson, 1991), users can move readily between the knowledge base on DSM-III-R Axis II personality disorders and a diagnostic skills testing component. They may explore any and all of the personality disorders in a self-directed manner, encountering information related to diagnostic criteria, clinical presentation, differential diagnosis, and case examples. Students testing their diagnostic skills can access case simulations and receive reinforcing or corrective feedback for their efforts. Users also have online access to Axis II diagnostic criteria, which are used to make diagnostic decisions in real clinical situations. The feedback provided on diagnostic choices gently confronts users with the limits of their knowledge. Users can move directly back to the knowledge base for further knowledge acquisition or continue their diagnostic skills testing.

The range of possible applications of hypermedia CBE to social work curriculum content is limited more by constraints of time, resources, and imagination than by hardware or software. For example, it is now possible to display video film clips with accompanying audio on a portion of a standard Apple Macintosh screen using Apple Computer's Quicktime software technology. Previously, sound and video output in CBE had been available only through the linkage of a videodisk player, a computer, and a television monitor. (Film clips, stored on a videodisk and activated via a computer, were displayed on a television screen [Lynett, 1988; Reinoehl & Shapiro, 1986; Seabury & Maple, 1993]). The Quicktime technology makes it possible to view video information on a computer terminal without additional hardware and cost.

A complete cost analysis for creating a hypermedia CBE program is beyond the scope of this discussion. Costs vary, depending on the educational goals, program design, range of expertise and expense of personnel involved, hardware and software needed, and types and amounts of media incorporated in the program. HyperAxis II was produced by the senior author for less than $200, with about 400 hours of development time. Commercially developed hypermedia CBE programs with integrated sound and video cost about $250,000 for four hours of instruction (Tynan, 1993). In university settings, costs can be controlled by (a) forming interdisciplinary, collaborative production teams; (b) sharing hardware, software, and equipment among departments or computer centers; and (c) incorporating existing course content material such as clinical video tape footage (Seabury & Maple, 1993).

One potential application of hypermedia CBE in social work education is in an instructional program on social policy. Content material on the policy-making process could be linked to film clips showing, for example, families struggling with a current social problem such as inadequate health care, legislative hearings on health care reform, and interest group representatives advocating and resisting policy reform. The user could access charts illustrating the relative power and positions of key players at various stages in the political process. Moreover, supportive documentation such as newspaper articles, copies of legislation, and fiscal graphs and financial material, along with recorded comments and reflections from policy makers, could be incorporated into the program. This enlivening and real portrayal of social policy formulation moves the content material from the abstract to a tangible representation of the process.

Hypermedia CBE could also be applied to a course on psychopathology. Users exploring the knowledge base could access sound and video output illustrating pathological conditions such as tardive dyskinesia, loose associations, and dissociative states. Digitized graphics can be animated in hypermedia programs to demonstrate a variety of processes relevant to social work, including the effects of medication at a synaptic level, client movement through service provision networks, and the impact of governmental policy across service delivery systems. Moreover, community resource databases in which services, resources, and referral information data are cross-linked could be constructed with integrated case simulations that teach case management skills in resource allocation and client linkage. Utilization of this emerging technology in social work education not only has the potential for increasing educational efficacy (Patterson & Yaffe, 1993), but can also stimulate application of the technology toward the solution of social problems.

Hypermedia CBE Components

Numerous instructional components and programmatic features can be built into a hypermedia CBE program to enhance its efficacy and utility (Jonassen, 1986; Sorenson, 1989; Tsai, 1988). Sorenson has proposed that hypermedia CBE programs display a consistent interface that allows users to focus on the instructional material without having to reorient themselves as they move to new screens. He has also suggested that programs allow for a high degree of individual content selection and interactivity with the information.

Furthermore, Sorenson (1989) has recommended that hypermedia CBE programs include features such as online progress indicators, location and route tracking, automatic accumulation of information, report generation, self-testing capabilities, and updatability (p. 186). Online progress indicators report either a running percentage of the program completed or the accuracy of responses in self-testing. Location and route tracking allows users to access a screen displaying where they are in the program and where they have been. This feature may prevent users from becoming "lost in hyperspace." Automatic information accumulation features may be operated either to inform users about their performance or to collect data. Report generation can print information selected by users or provide student performance reports for instructors. Hypermedia CBE programs can also contain self-testing components that enable users to measure their knowledge acquisition. Finally, hypermedia CBE programs should be readily updatable to keep pace with information changes.

Hypermedia and Expert Systems

Hypermedia CBE programs can be combined with the related computer technology of expert systems for potentially significant synergistic effects (Littleford, 1991). Expert systems are computer programs that emulate the decision-making process of human experts within a particular realm of knowledge (Liebowitz, 1988). They combine a knowledge base that stores rules and facts with a resources information database, a user interface (a computer screen to input and receive information), and inferential algorithms that supply the logic of the decision-making process (Kelly, 1993, 1994; Pittman & Kelly, 1990, Schoech, 1990). Expert systems can help users to reach decisions in complex, procedure- or rule-bound settings such as child protective services.

One can envision a hypermedia CBE child welfare training system that integrates clinical case descriptions, a child protective services expert system, and child protective services training information. In such a system, the user would be provided with the facts of a case, and would input those perceived as relevant into the integrated expert system to determine the most appropriate course of action. Finally, the user could access film clips and text material that demonstrate and discuss the actions recommended by the expert system. At least two systems similar to the one described here are currently under development (Patterson, 1993; D. Schoech, personal communication, October 1992).

Conclusion

During the 32 years since the first CBE program was written, dramatic advances have altered the hardware, software, and instructional theory associated with CBE. CBE programs have changed from linear, lock-step presentations of text-filled screens to user-directed, multisensory, interactive programs. Those who have witnessed demonstrations of well-designed hyper-media programs are generally impressed by the remarkable technology. The combination of digitized graphics, animation, sound, video, and multifonted text can be highly enticing.

Nonetheless, the decision to devote time and resources to exploring and developing instructional material in hypermedia programs is far from automatic, for the necessary theoretical foundations have not kept pace with the technological advances. The prudent course entails both developing the theory to guide construction of hypermedia for social work education and testing its efficacy against the traditional educational methods of classroom instruction and text-based training manuals.

REFERENCES

American Psychiatric Association. (1987). *Diagnostic and statistical manual of mental disorders* (3rd ed., revised). Washington, DC: Author.

Begoray, J. A. (1990). An introduction to hypermedia issues, systems and application areas. *International Journal of Man-Machine Studies, 33,* 121-147.

Bobrow, D. G., & Norman, D. A. (1975). Memory schemata. In D. G. Bobrow & A. Collins (Eds.) *Representation and understanding: Studies in cognitive science* (pp. 131-149). New York: Academic Press.

Cartor, R. A. (1990). A comparison of andragogy and pedagogy: Assessing the relationship between individual personality differences, learning styles, and training types (Doctoral dissertation, University of Tennessee, 1990). *Dissertation Abstracts International, 52,* 1760B.

Collins, B., Oberg, A., & Shera, W. (1988). An evaluation of computer-based instruction in statistical techniques for education and social work students. *Journal of Educational Technology Systems, 17,* 59-71.

Edwards, D. M., & Hardman, L. (1989). "Lost in hyperspace": Cognitive mapping and navigation in a hypertext environment. In R. McAleese (Ed.), *Hypertext theory into practice* (pp. 105-125). Norwood, NJ: Ablex.

Gleick, J. (1987). *Chaos: Making a new science.* New York: Penguin.

Goldberger, A. L., Rigney, D. R., & West, B. J. (1990, February). Chaos and fractals in human physiology. *Scientific American,* pp. 42-49.

Goodman, D. (1988). *The complete hypercard handbook.* New York: Bantam Books.

Green, M. M. (1988). An evaluation of computer-assisted instruction in social work (Doctoral dissertation, University of Utah, 1988). *Dissertation Abstracts International, 49,* 1964A.

Hansen, J. B. (1981). *An evaluation of computer-assisted instruction (CAI) for teaching statistics to social work students.* Unpublished doctoral dissertation, University of Toronto.

Hudson, W. W. (1985). Computer managed instruction: An application in teaching introductory statistics. *Computers in Human Services, 1*(1), 117-123.

Jaffe, C. C., & Lynch, P. J. (1989, September). Hypermedia for education in the life sciences. *Academic Computing,* pp. 10-57.

Jonassen, D. H. (1986). Hypertext principles for text and courseware design. *Educational Psychologist, 21*(4), 269-292.

Kelly, M. J. (1993). Desktop expert systems: Applications for social services. *Computers and human services, 9*(3 & 4), 361-370.

Kelly, M. J. (1994). Teaching applications of expert systems. *Teaching in Social Work, 9*(1/2), *37-47.*

Kozma, R. B. (1991). Learning with media. *Review of Educational Research, 16*(4), 179-211.

Knowles, M. S. (1980). *The Modern Practice of Adult Education* (rev. ed.). Chicago: Associated Press.

Lanza, A., & Roselli, T. (1991). Effects of the hypertextual approach versus the structured approach on students' achievement. *Journal of Computer-Based Instruction, 18*(2), 48-50.

Liebowitz, J. (1988). *An introduction to expert systems.* Santa Cruz, CA: Mitchell.

Littleford, A. (1991). Artificial intelligence and hypermedia. In E. Beck & J. Devlin (Eds.), *Hypertext/hypermedia handbook* (pp. 357-378). New York: Intertext Publications.

Lynett, P. (1988). The current and potential use of computer assisted interactive videodiscs in the education of social workers. *Computers in Human Services, 1*(4), 75-85.

Mahoney, M. J. (1991). *Human change process: The scientific foundations of psychotherapy.* New York: Basic Books.

Nelson, T. H. (1974). *Dream machines: New freedom through computer screens—A minority report.* Chicago: Hugo's Book Service.

Nelson, T. H. (1978). Electronic publishing and electronic literature. In E. C. DeLand (Ed.), *Information technology in health science education* (pp. 34-47). New York: Plenum.

Nielsen, J. (1990). *Hypertext & hypermedia.* Boston: Academic Press.

Norman, D. A. (1973). *Cognitive organization and learning* (ERIC Document, ED 083 543). San Diego: University of California, Center for Human Information Processing.

Patterson, D. A. (1991). Hypertext computer aided instruction in training graduate students in the use of the diagnostic and statistical manual axis II (Doctoral dissertation, University of Utah, 1991). *Dissertation Abstracts International, 52,* 1524A.

Patterson, D. A. (1993). *Directions and Options in Computer Based Education.* Unpublished manuscript, University of Tennessee, Office of Research and Public Service, Knoxville.

Patterson, D. A., & Yaffe, J. (1993). An evaluation of computer-assisted instruction in teaching axis II of DSM-III-R to social work students. *Research on Social Work Practice, 3*(3), 343-357.

Pittman, S. & Kelly, M. J. (1990). "ILRA": A knowledge based system link to an electronic resource file. *Information and Referral: The Journal of the Alliance of Information and Referral Systems, 12*(1/2), 16-27.

Reigeluth, C. M. (1983). *Instructional design theories and models: An overview of their current status.* Hillsdale, NJ: Lawrence Erlbaum Associates.

Reinoehl, R., & Shapiro, C. H. (1986). Interactive videodiscs: A linkage tool for social work education. *Journal of Social Work Education, 22*(3), 61-67.

Schoech, D. (1990). *Human service computing: Concepts & applications.* New York: Haworth.

Seabury, B. A., & Maple, F. F. (1993). Using computers to teach practice skills. *Social Work, 38*(4), 430-439.

Slotnick, R. S. (1990). Academic computing in psychology. *Social Science Computer Review. 8*(4), 558-591.

Sorenson, D. K. (1989). General principles of hypermedia computer-aided instruction. In W. E. Hammond (Ed.), *Proceedings of the Congress of Medical Informatics* (pp. 185-189). Washington, DC: American Association for Medical Systems and Informatics.

Tsai, C. J. (1988). Hypertext: Technology, applications, and research issues. *Journal of Educational Technology Systems, 17*(1), 3-14.

Tynan, D. (1993, July). Multimedia goes on the job—Just in time. *New Media,* pp. 39-46.

Van den Berg, S., & Watt, J. H. (1991). Effects of educational setting on student responses to structured hypertext. *Journal of Computer-Based Instruction, 18*(4), 118-124.

Accepted 10/93.

Address correspondence to: David A. Patterson, College of Social Work, University of Tennessee, 1618 Cumberland Ave., Knoxville, TN 37996-3333.