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Educator change during the adoption of hypermedia

Dennis Wayne McElroy
Iowa State University

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Educator change during
the adoption of hypermedia

by

Dennis Wayne McElroy

A Thesis Submitted to the
Graduate Faculty in Partial Fulfillment of the
Requirements for the Degree of

MASTER OF SCIENCE

Department: Curriculum and Instruction
Major: Education (Curriculum and Instructional Technology)

Signatures have been redacted for privacy

Iowa State University
Ames, Iowa

1992
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CHAPTER I. INTRODUCTION

According to Sheingold, Hawkins and Kurland (1981), there can be no question that instruction dealing with computer technologies will be a part of both the formal and informal educations of children. By the beginning of the 1988 academic school year, an estimated 1.7 million computers were being used by public schools. Telecommunications and interactive videodisc technologies were just beginning to be introduced by some school districts. By 1987, however, less than one-third of the nation's teachers had received even ten hours of technology training. The emphasis of much of this training was general literacy or introductory material (OTA, 1988). The study goes on to report that only fifty percent of the nation's classroom teachers have ever used a computer in the classroom. One of the difficulties leading to this low level of use is lack of preservice preparation (Fulton, 1989). Exposure to computers for preservice teachers is being limited by universities for a variety of reasons. Prevalent among these are the low levels of use that university faculties make of computers.

Policy makers of today's school systems must focus on particular technology-related areas for proper technology integration into the curriculum. Kathleen Fulton of the Office of Technology Assessment for the U. S. Congress (1989) describes these areas as: (1) expanding the amount and capability of technology in schools to provide for increased student access; (2) encouraging design and exploration in the field of educational software development; (3) creating exploratory ties between technology research and development and the classroom; and (4) providing training and support for teachers.
The rapid evolution of technologies available to school systems is a prime factor producing the need for staff development in schools today (Fulton, 1989; Glenn and Carrier, 1989). The path of technology development has moved to the point at which teachers can produce their own materials. One such example of an authoring environment is hypermedia. Hypermedia is the interactive application of a variety of integrated media or multimedia, including computers and videodiscs.

Hypermedia is a system derived from hypertext; the non-linear or dynamic text concept designed by Theodor Nelson (Jonassen, 1988). It has the capability to empower users to develop their own software products to fit their particular educational environments and provide a high degree of instructional latitude. This tool has the potential to make positive improvements in instruction. The problem is the lack of knowledge concerning hypermedia and techniques for its implementation.

Educators play key roles in the adoption of new innovations such as hypermedia. The teacher is primarily responsible for curriculum development and the integration of available technologies into that curriculum. Modification of teacher attitudes and implementation behaviors is necessary to prepare teachers for technology integration. An effective method of modifying teacher behavior and attitudes is staff development (Winkler and Stasz, 1985; Lawrence, 1974; Madsen and Sebastiani, 1987; Guskey, 1986). Inservice of teachers, technology or computer coordinators, and administrators is a pathway that will foster the implementation of new innovations.

For the educational community to make a successful shift to an information-based system, staff development must be made available to provide
teachers with technology implementation skills and techniques (OTA, 1988). Educators will make a commitment to the implementation process of a new innovation only if the innovation's application is perceived as being relevant and synchronized with their viewpoint concerning the change. The changes in attitude and behavior will enable teachers to function as facilitators of student learning, rather than in their traditional role as dispensaries of ready-made information. By making this change in roles, teachers see more of the learning process and the range of opportunities for reaching students increases (OTA, 1988).

Computer-related instruction that will optimize administrative and teacher commitment through a direct relationship to improvement of our school's product - the student - is promoted in the literature (Daresh, 1985; McLaughlin and Marsh, 1978; Smylie, 1989). The creation of an appropriate inservice environment is necessary to cultivate the commitment and develop the knowledge base of the participants to help prevent alienation of the concept/innovation.

Adoption and Diffusion of Communication Innovations

Introduction of an innovation into a system leads to either an adoption or rejection decision and potentially, innovation diffusion by the members of this system. Users pass through phases of awareness, make relative value and compatibility judgments, make the adoption/rejection decision, and seek sources that confirm the decision. The use of computer-related technology by educators during the past 10-15 years is an example of an innovation that has rapidly diffused throughout many educational systems. It is important to study the
effects of technology on the educational social order to provide for improved adoption and diffusion practices.

Hypermedia is a recently developed innovation that is only beginning the process of diffusion into and through educational systems. It is important for research to provide information concerning the development of and training for the use of innovations such as hypermedia. The adoption/diffusion theory (Rogers, 1974) provides an adopter-based framework through which this research can be conducted. A study of the characteristics of the adopters, their judgments concerning the innovation, and the perceived positive and negative characteristics of the innovation is necessary to provide information to improve the innovation and the process of change itself.

Concerns-Based Adoption Model

The Concerns-Based Adoption Model (CBAM) characterizes the way a person's concerns change during the innovation adoption process (Hall, Wallace, and Dossett, 1973). It is based on research by Francis Fuller (1969) about student teacher's concerns. Fuller identified the following phases of concerns development: (1) pre-teaching (non-concern), (2) early teaching (self concerns), and (3) late teaching (concern with pupils).

Hall and Hord (1987) outline several assumptions underlying the Concerns Based Approach Model. These are:

• Understanding the point-of-view of the participants in the change process is critical.
• Change is process, not an event.
• It is possible to anticipate much that will occur during a change process.
• Innovations come in all sizes and shapes.
• Innovation and implementation are two sides of the change process coin.
• To change something someone has to change first.
• Everyone can be a change facilitator.

The Stages of Concern Questionnaire (SoCQ), proposed in 1973 by Hall, Wallace, and Dossett, makes an assessment of seven hypothesized Stages of Concern (SoC) about an innovation. Concerns develop as the individual becomes more familiar and involved with innovations, but may not follow the same sequence as shown in the model (Appendix B, Figure B-1).

Hall and Hord state that the concerns-based approach emphasizes understanding teacher attitudes and skills so that support activities can be directly related to what teachers perceive they need. They hypothesized that there was a set of developmental stages and levels that teachers moved through as they became increasingly sophisticated and skilled in using new programs and procedures. These stages are summarized as follows:

• Awareness Stage 0 - little concern or involvement with the innovation.
• Informational Stage 1 - awareness and desire to gain information about the innovation.
• Personal Stage 2 - concern with the demands of the innovation upon the individual
• Management Stage 3 - attention is focused on efficient organization and use of the innovation.
• Consequence Stage 4 - assessment of the innovation effects in the classroom.
• Collaboration Stage 5 - attention to coordination and cooperation efforts with peers.
• Refocusing Stage 6 - exploration of potential adaptations or replacement of the innovation.

Statement of the Problem

While a wide range of data is available concerning the effects of staff development involving such applications as tutorials and data bases, information pertaining to hypermedia staff development efforts is limited. An assessment of the effect of hypermedia during staff development on teacher attitudes, concerns, and knowledge retention need to be conducted. This study will also analyze demographic characteristics and post-workshop support usage. Such an analysis would help hypermedia staff developers appropriately plan future projects.

Purposes of the Study

The purposes of this study were to assess the effects of a two week workshop on:
• cognitive knowledge retention
• participant level of concern about hypermedia
• evaluate the subject's attitudes concerning technology
Research Questions

Attitudes About the Use of Technology in Education
1. Will the participant's attitudes concerning the use of technology in education, as measured by the attitudinal section of the Iowa Survey of Computer Related Technology Use by K-12 Teachers, change during the initial stages of the innovation adoption process?

Concerns Related to the Adoption of the Innovation
1. Will the levels of concern of the participants, as measured by the Stages of Concern About the Innovation Questionnaire, change and follow a progressive developmental pattern during the early stages of the innovation adoption process?

Hypermedia Knowledge and Skills
1. Will the participant's knowledge level, as measured by the Hypermedia Knowledge Test, change during the initial stages of the innovation adoption process?
Definitions

Adoption - the acceptance of an innovation by a subject.

Change Agent - individual or adoption group that has some type of experience with an innovation. These individuals use various channels of communication to facilitate the transfer of information about the innovation.

Communications Innovation - multimedia communication systems that include: microcomputers, teleconferencing, teletext, videotext, interactive cable television, and communications satellites

Concerns-Based Adoption Model (CBAM) - Used to evaluate and assess various characteristics of adopters as related to an innovation. This information is used to modify the actual staff development practices concerning the innovation to fit the concerns and needs of the participants.

Diffusion - the process by which an innovation spreads through a social system.

Hypermedia - an environment that provides users with non-linear, interactive access to a variety of information that is presented via integrated media, including computers and videodisks.

Hypermedia Knowledge Test (HKT) - A cognitive test of hypermedia knowledge and concepts.

Hypermedia Usage Questionnaire (HUQ) - used to assess the general level of use of hypermedia, the detrimental effectors, and available support mechanisms.

Hypertext - the non-linear or dynamic text concept designed by Theodor Nelson. Based on the idea that active text is used to access related materials by clicking on it with a pointing device such as a mouse.

Innovation - a new idea or method.
The Iowa Survey of Computer Related Technology Use by K-12 Teachers (ISCRT) - a survey used to assess the level and type of technology use in Iowa. Developed by Denise Schmidt and the Iowa Department of Education

Multimedia - a combination of text, sound graphics, animation, and video under computer control.

Stages of Concern Questionnaire (SoCQ) - used to assess types of dominant concerns an individual has about an innovation.
CHAPTER II. REVIEW OF THE LITERATURE

If interactive multimedia is to be effectively implemented in education, appropriate staff development programs must be created. These programs must be patterned after staff development principles that have proven effective. A review of staff development theory and literature is necessary in order to understand the various components of staff development and their effects on the individuals involved. The first section will address research issues concerning factors that contribute to the effectiveness of inservice training and staff development in education as it is related to technology instruction. Adoption and diffusion of innovations is the primary goal of many staff development efforts. The second section discusses the adoption and diffusion of innovations in relation to educational staff development and technological innovations. Measurement of participant concerns about an innovation can be helpful in the development of a staff development project. Section three will focus on the various aspects of the Concerns-Based Adoption Model (CBAM) and its role in educational staff development projects. Section four will address the various attributes of hypermedia relating to the educational environment and staff development.

Factors That Contribute to Successful Staff Development Programs

A variety of factors influence the impact of a staff development program including:

• Design of the staff development program
• Motivation and change
• Learning styles and inservice presentation
• Resources and support
• Analysis of the effects of computer-related inservice

**Design of the Staff Development Program**

According to Dedrick, Decker and Hansen (1989), educator professional growth is broken into four distinct stages:

- induction
- adjustment
- maturation
- mid-career crisis leadership

These stages provide the impetus or desire to increase knowledge in a particular area. The inservice itself should be designed to provide impact in a graduated sequence by providing initial awareness of the topic, an understanding of the inherent concepts and their relationships to the learning process, skill acquisition, and application/problem solving. They suggest a variety of strategies and techniques for staff development training. These include simulations, quality circles, retreats, videotaped presentations, role playing, and inner-circle discussion.

When the focus of staff development is computer-related technologies several characteristics and requirements distinguish it from other forms of training. The need for computers, both in the training and the classroom afterward, creates a unique problem for staff developers. In addition, the teacher's lack of background experience prior to computer-related inservice can cause a number of problems. For these reasons, technology training must be
carefully planned and take into account these and other characteristics (Office of Technology Assessment (OTA), 1988).

Analysis of successful staff development programs have identified several instructional practices that have proven effective. These practices are integrated into the program prior to its implementation:

- Addressing teacher concerns
- Placing the teacher in an active role
- Offering individualized learning experiences
- Placing emphasis on demonstrations, supervised trials, and immediate feedback
- Understanding the change process
- Providing trainers who are credible and capable of presenting material clearly and explicitly
- Linking to work-related material such as student achievement and teaching methods (Guskey, 1986; Rappa et al., 1983; Hall, 1977; Lawrence, 1974; The Office of Technical Assessment, 1988)

Six additional practices identified by the OTA have been shown to increase the effectiveness of the staff development effort: (1) create a balance between lecture and guided practice, (2) produce detailed curriculum guides and lesson plans, (3) create clear and relevant objectives, (4) relate materials and handouts to inservice lessons, (5) foster peer interaction, and (6) provide for followup activities. While none of the reviewed studies combined all of these practices, various combinations in conjunction with positive classroom experiences contributed significantly to the effectiveness of the inservice program.
One of the most important elements of staff development programs is identification and integration of teacher concerns into the design process (Guskey, 1986; Rappa et al., 1983; Lawrence, 1974; Hall, 1977; Hord et al., 1987). The national congressional report on educational technology states that "inservice training in technology must be sensitive to the concerns or anxieties" of the participant (OTA, 1988, p. 104). The concerns of the participants can vary widely. Some will enter a staff development program with previous negative or positive experiences with technology. All participants will enter the program with varying levels of concerns as outlined by Hall (1977) and Hord et al. (1987). These concerns must be addressed to make the program as efficient and practical as possible.

Motivation and Change

Guskey (1986) pointed out two major failures found in unsuccessful staff development programs. They were (1) not understanding the process of change in teachers and (2) not taking into account what motivates teachers.

The change process has been the focus of much research concerning training programs (Guskey, 1986; Hall, 1977; Rogers, 1986; Cicchelli and Baecher, 1987; Office of Technology Assessment; 1988). Designers of staff development programs need to recognize that the change process can be gradual and difficult for the participants. This process requires extra time and energy to develop and generally increases anxiety (Guskey, ibid). Staff developers must be aware of the changes that are taking place and influencing the outcome of the program. Careful attention to participant changes will contribute highly to producing more
effective and powerful staff development programs. The process of change is
discussed in further detail on page 34.

Incentives will play a key role in the teacher's decision to participate in
staff development of microcomputer-based instruction (Winkler and Stasz, 1985;
Guskey, 1986; Shavelson et al., 1984; U. S. Department of Education Task Force,
1981; Office of Technology Assessment, 1988). Direct involvement in the
decision-making process (Winkler and Stasz, ibid) and the desire to become
better teachers (Guskey, ibid) are two important factors affecting participation.
Many teachers believe that attendance of the inservice program will result in a
contribution to their growth and will enhance their classroom effectiveness.
Other incentives found to influence teacher participation include:

- Availability of resources and support personnel
- Release time
- Access to computers
- Professional recognition
- Incremental salary credit
- Reimbursement for coursework
- Addressing teacher concerns (Winkler and Stasz, 1985;
  Guskey, 1986; Page and Wallig, 1983; Cicchelli and Baecher,
  1987; OTA, 1988)

Incentives that go beyond these to encourage participation must be offered
(OTA, 1988). These can include (1) the use of a computer for every teacher at
home and work, (2) software acquisition grants, (3) sabbaticals for research or
educational application development, and (4) paid participation in professional
conferences. Incentives may not only provide the impetus for teacher
participation in staff development programs, but may provide the means for retaining trained teachers in the school systems.

**Learning Styles and Inservice Presentation**

The dissimilarity of the participant's knowledge, experience, concerns, etc. are a critical element of staff development efforts. Inservice education programs that are individualized are more likely to accomplish their objectives than are programs that have common activities for all participants. In addition, these programs should include demonstrations, supervised trials and feedback to help the participant put new information to immediate use rather than storing it for some future time (Lawrence, 1974; OTA, 1988).

The level of participation and decision making by the participant is important in the inservice program. The OTA study reported that technology directors and superintendents believe that teachers and their concerns should be a part of the decision making processes of planning inservices. This is supported by several studies (Winkler and Stasz, 1985; Lawrence, 1974; Guskey, 1986).

The following list identifies effective characteristics of presenters and presentation styles:

- Present the innovation in a clear and explicit manner
- Stress concrete experiential learning
- Use of concrete examples that are aimed at specific teaching skills
- Present material in a positive manner
- Place the participant in an active, exploratory role
- Use of cooperative and individualized learning
• Use of examples that indicate specific applications for student achievement
• Present new teaching methods
• Allow enough time for learning and not just browsing
• Providing a trainer that has credibility with the participants and understands the change process (Rappa, 1983; Guskey, 1986; Lawrence, 1974; OTA, 1988)

In combination with evidence of positive classroom implementation, these characteristics contribute highly to the success of a staff development program. Careful attention to the teacher changes taking place will contribute highly to producing more effective and powerful staff development programs.

Support and Resources

The importance of available resources and post inservice support is suggested in the literature (Egan, 1988). Teacher development must be identified as a continual process that is exemplified by appropriate support/followup activities. Rappa et al. (1983) ascertain that with the passage of time peer and supervisor support will become more influential as to the continued usage of information, skills and behaviors.

Followup activities that include hands-on experience are extremely important if teachers are to learn concepts and principles. Other support/followup features that contribute to successful inservice programs include:

• cooperative peer support
• immediate student feedback
• ideas for multiple application of instruction
• release time during the school day
• providing continued incentives and rewards
• participation in professional conferences
• exchange of ideas via telecommunications
• continued sensitivity to teacher concerns (Egan, 1988; OTA, 1988; Loucks-Horsley et al., 1989; Ellis, 1989)

The appropriation of resources contributes highly to the adoption of innovations and practices. Two important resources are time and availability of material. The amount of time allocated to an innovation is indicative of its importance to the school and students. The availability and quality of materials can be a severe limitation on the application of an innovation. The materials must be coherent with the existing curricular framework and be of proven quality (Loucks-Horsley et al., ibid).

A key factor contributing to support and availability of resources is school leadership. When leadership personnel participate in the decisions related to an innovation, it is more likely to be perceived as helpful and supportive. Leadership personnel are not limited to superintendents and principals. While these personnel have been found to be critical to staff development (Rogers, 1986), leadership roles can be filled by master teachers, external staff developers, and others (Loucks-Horsley et al., ibid).

Analysis of the Effects of Computer-Related Inservice

According to Cleborne Maddux (1984), the field of education has seldom been as frantically enthusiastic about an instructional innovation as it currently
is about educational microcomputing. A critical component of successful implementation of a computer-based education is positive teacher attitudes toward computers and computerized instruction (Lawton and Gerschner, 1982). To implement meaningful computer-based education, meaningful preparation is needed (Hannafin et al., 1987). Lawton and Gerschner (ibid) suggest the implementation of staff development programs which provide experiential practice for teachers.

Madsen and Sebastiani (1987) conducted a study to measure the changes of inservice participants in knowledge of and attitude toward computers. Using a pretest-posttest control group design, the group was divided into two equal parts with one being assigned as the control who received no formal or informal training. All secondary contact areas within the district were represented. No previous computer inservice instruction had been available and no microcomputers had been available for classroom usage.

Madsen and Sebastiani found that participation in computer literacy inservice significantly improves attitudes concerning computers and knowledge about computers. They go on to state that in view of the substantial hardware and software investments made by many school districts and the results of this study inservice computer literacy courses should be an important consideration.

Vitchoff’s (1988) study provided training designed to increase classroom supplemental computer usage for fourth through sixth grade teachers and their principals. The objectives of the study were to avoid rote memory and instead produce mastery and accomplishment by the end of each workshop. A self-evaluation was administered to the participants before and after they received software and hardware training.
According to Vitchoff, the participants demonstrated understanding of how to work a personal computer. Teachers accepted, integrated and were more confident in the use of computers when the workshop was thorough and well paced. Two key aspects of successfully meeting the objectives were accessibility of computers and support personnel. The study suggests that teachers need the support of the principals in computer training. In addition, teachers should be allowed to have direct input in the requisitioning of new curriculum software.

Gressard and Loyd (1985) studied age and participation in a computer related staff development program. The program design covered computer history, uses, programming and hands-on experience for forty-one noncomputer using K-12 teachers from Virginia. The study found the following:

- A staff development program can be effective in improving the computer attitudes of teachers.
- Anxiety was significantly decreased while confidence was increased.
- Age was not found to be a contributing factor in the teachers' attitudes concerning computers.

Adoption and Diffusion of Innovations

This section of the literature review will address the concept of adoption and diffusion of innovations in the educational society. The section will begin by providing information that will help to provide an understanding of the adoption/diffusion theory. The following aspects of the adoption/diffusion theory will be discussed to build a picture of their varying influences:

- Innovation attributes
• The decision process
• The diffusion process

Discussion defining communications technologies and their relationship to adoption/diffusion is provided in order to portray the differences found between these technologies and non-communications technology innovations. Several important factors that influence the adoption and diffusion of communications technology innovations will be addressed. These are:

• Social impacts
• Gender Differences
• Information overload and decentralization

Emphasis will be placed on information about the adoption/diffusion theory as it pertains to K-12 staff development concerning communications technologies.

**Adoption Diffusion Theory**

Introduction of an innovation within a social system produces changes leading to an adoption or rejection decision. This creates the potential for the diffusion of the innovation by the members of this system. The adoption diffusion theory is based on a series of stages the user experiences:

• Awareness
• Making value and compatibility judgements
• Making an adoption or rejection decision based on the judgements
• Implementation of the innovation
• Seeking sources that will confirm their decision (Rogers, 1986)
Innovation Attributes

The process of adoption focuses around the perceived attributes of the innovation (Rogers, 1974; Hurt and Hibbard, 1989). The attributes of an innovation and their effect (+/-) on adoption include:

• Relative advantage (+) - the extent to which an innovation is perceived as being better than the idea preceding it.

• Compatibility (+) - the degree to which an innovation consistently meets the expectations developed from the receiver's existing values, past experiences, and needs.

• Complexity (-) - the degree of complexity of the innovation as perceived by the receiver.

• Trialability (+) - the degree of accessibility/availability of the innovation for limited experimental use.

• Observability (+) - the extent to which the results of an innovation are visible and easily communicated to others (Rogers and Shoemaker, 1971).

Of these attributes, the perceived degree of relative advantage and compatibility of the innovation seem to be the most powerful discriminators between potential adopters and nonadopters (Bolton, 1983).

The Decision Process

Rogers (1986) describes the innovation-decision process as a cognitive process in which a decision maker passes through a series of stages concerning the decision to adopt an innovation. The judgements and decision concerning the innovation's adoptability are influenced by the innovation, channels of
communication, time, and the members and/or characteristics of the social system (Rogers, 1986).

Early adopters generally require much less time than later adopters to pass from the knowledge stage to the decision and confirmation stages. The primary group which becomes aware of and retrieves knowledge about an innovation earlier than their peers would show the earliest and quickest gains in adoptive/rejective actions.

Provisions for the establishment of support mechanisms are necessary to contribute to the desired adoption decision. Support mechanisms can be used independently or in varying combinations. Examples of support mechanisms are (1) implementation assistance, (2) creation of peer group experts, (3) emphasis of relative advantages of the innovation, (4) providing trialability opportunities, and (5) accessing user concerns (Stewart, 1982; Rogers and Thomas, 1975).

The Diffusion Process

The diffusion process takes place through the interaction of three primary components. The (1) innovation is used and modeled by an (2) individual or adoption group that has some type of experience with the innovation. These individuals or change agents use (3) various channels of communication to facilitate the transfer of information (Rogers, 1974). These communication channels consist of mass or interpersonal communication. According to Rogers, interpersonal channels are needed to change attitudes and behaviors of potential adopters.

Change agents play a integral part in the adoption-diffusion process. It is important that the personnel chosen to effect the desired change be known and...
accepted by the receivers. This will provide a characteristic harmony between the desired knowledge level concerning the innovation and credibility with the receiving organization. In general, these innovators are:

- more knowledgeable
- open to change
- highly motivated
- cosmopolitan
- mobile
- venturesome (Stewart, 1982).

Adoption and Diffusion of Communications Technologies

A new communications system made available by computer-based technology is called interactive or machine-assisted interpersonal communication. This combines interpersonal and mass communication techniques (Rogers, 1986). The interactive capability of computer-based systems allows the system to "talk back" to the user. According to Rogers, this capability for interactive communication provides for the de-massification of the system (the system is user controlled). User control characteristics increase the system's convenience level for the user and has the characteristics of interpersonal communication. Compared to the one-way communication systems, interactive communication technologies are more likely to be perceived as informational than as entertainment. This discussion concerning communications technologies will address:

- What are communications technologies?
• How communications technologies differ from other innovations
• Social impacts of communications innovations

What are Communications Technologies?

Communications technologies provide for the integration of a variety of media forms to form multimedia systems. These multimedia communication systems include: (1) microcomputers, (2) teleconferencing, (3) teletext, (4) videotext, (5) interactive cable television, and (6) communications satellites. The integrational characteristics and the degree of user friendliness of these technologies combine to form a communication system that contains many of the positive attributes of interpersonal and mass media communications (Rogers, 1986).

Computerized communication has the capability to emulate interpersonal interaction, while demanding specific user skills. It has advantages over direct face-to-face communication, but suffers from some disadvantages as well. The degree to which a computer allows two individuals to converse with the ease of face-to-face communication is called user-friendliness.

How Communications Technologies Differ From Other Innovations

Diffusion of communication technologies differ from the spread of other innovations. According to Rogers (1986) these differences are (1) critical mass, (2) degree of re-invention, and (3) degree of implementation and use of the innovation.
A critical mass of adopters must be reached for the adoption of an communications innovation to occur. Each additional adopter of the system increases the usefulness of the system for all of the users. Critical mass is crucial to the adoption of a communications innovation due to the innovation's interactive nature. This factor is a negative influence during the initial stages of diffusion.

The ability of the innovation to be customized by the user rather than being accepted as a standardized innovation. The new communications innovations are considered tool technologies which are capable of being used in a variety of ways in many diverse situations. By re-inventing, modifying and personalizing the tool technology, the user is demonstrating a very active participation level rather than passive acceptance of a standardized innovation.

The critical factor in diffusion studies concerning communications technologies is the level of use of the innovation rather than the actual adoption of the innovation. Due to the extended period of time required for full group adoption, the level of use is often considered the bottom line for acceptance of an innovation.

The early adopters of the new communications innovations differ from later adopters in (1) socioeconomic status, (2) communications behaviors, and (3) personality variables. Early adopters differ from later adopters in income, occupational prestige, and the years of formal education. These factors can stand independently or work together in an integrated manner. Their higher income reduces cost factors. More occupational prestige places users in positions that expose them to innovations. Higher education allows the user to more easily evaluate the innovation. Early adopters show a higher level of cosmopolitan
orientation. This is the degree to which they are oriented outside their own social system. A higher degree of exposure to mass media communications channels leads to independence from interpersonal communications channels. The early adopter typically is characterized as being less opinionated and more informed about the innovation, exhibits a heightened degree of empathy towards individuals around them, is able to function in the abstract, and exhibits a high degree of rationalism in constructing the best path to achieve their goals.

Social Impacts of Communications Innovations

The social impact of an innovation is the extent of the changes that take place in an individual or social system as a result of the adoption/rejection of an innovation (Rogers, 1986). Rogers classifies impacts according to how they tend to group together during the innovation process.

Positive Impacts:

Desirable impacts are those that help an individual or system function more effectively.

Direct impacts are the changes that take place in an individual or social system as a response to the innovation.

Anticipated impacts are changes that are recognized and intended by the individual or social system.

Negative Impacts:

Undesirable impacts are the dysfunctional effects on an individual or social system due to the innovation.

Indirect impacts are the changes that result from the direct impacts of the innovation.
Unanticipated impacts are changes that are not intended or easily recognized by the individual or social system. The social impacts of a communications innovation must be considered due to their effect not only on the workplace, but in the home. An individual who uses an innovation at home and at work will be affected differently than the individual that uses the innovation in one location only.

**Gender Differences**

Gender and age differences are often magnified by the use of communications technologies, in particular, microcomputers. The National Assessment of Educational Progress (1988) found that, in general, males demonstrate a slightly higher level of computer competency than females. Rogers (1986) refers to the widening of the math deficit caused by the use of microcomputers that is being experienced by women in American high schools.

Chen (1985) observed the difference in gender in relation to microcomputer skills in his dissertation study at Stanford. During the study of 1,138 high school students, several different subject disciplines were analyzed. Each of these content areas made allocations for the equal use of microcomputers by the students. While the majority of the courses were nearly equal in the gender ratio, the males showed nearly a 2:1 advantage in the computer programming courses. Chen (1985) found that only 0.4 percent of the girls that took computer programming completed three or more semesters as compared to 2.6 percent of the boys.

Noreen M. Webb (1985), reports in her Logo study that the gender gap is due to the types of opportunities available and the attitudes prevalent in our
society. Verbal interaction variables included in the study were: giving explanations, receiving explanations, receiving responses to specific questions, and verbalizing aloud while typing on the keyboard. Aptitude measures included: mathematics, verbal inference, nonverbal reasoning, and spatial ability.

Results of the study showed significantly higher pretest averages for the females in only non-verbal reasoning and no differences in verbal aptitude. The data showed that there were no significant differences in aptitude levels, verbal interaction, and learning outcomes between the genders. The females were able to spend equal or greater amounts of time at the computer and were as successful as the males in obtaining desired help.

A second, similar study by Webb (1985) was administered to fifty-five BASIC students. As in the Logo study, the student's work was self-paced and self-sufficient. The instructor was used for guidance purposes only. The study used the same verbal interaction variables found in the Logo study.

Results of this study were similar to the Logo study. The females again showed a significantly higher nonverbal reasoning score than did the males. The males and females did not differ on any other aptitude measure. The only significant difference in verbal interaction observations showed the males tended to talk aloud while they typed. The females showed a marginally significant advantage in design and operation planning. The study showed that the males and females demonstrated similar results on aptitude measures, behaviors, and outcomes.

The results of Webb's study show very few effects of gender on the aptitude and behaviors of the junior high age students. While the study suggests
that peer-direction in groups alleviates gender bias, a variation in age as suggested in the Chen study is not a factor here.

The reasons for the gender differences are many. According to Rogers (1986), parental expectations of sons and daughters are very different. Role models, the computer programmers and computer programming instructors, are predominantly male. The courses in computer programming offered in high schools require prerequisite math skills. The higher participation and performance by the males in the math courses leads to an imbalance of males to females in the computer programming courses. Rogers goes on to state that if these ambiguities can be alleviated the gender differences will become indistinct.

**Information Overload and Decentralization**

According to Rogers (1986) information overload results when an individual or individuals receive more information than can be processed at one time. The level at which this breakdown occurs is determined in part by the resident society's level of information technologies usage. The overload limits of a society increases as new innovations and information makes it easier to access and understand the already available information. Information technology using societies, such as Japan and the United States, will have a higher limit of new information acceptance prior to reaching an overload point. It must be noted that with the increased supply of information and new innovations, the increase in the overload limit becomes smaller as each piece of information competes for an audience.

Decentralization is characterized by the extent power and control are shared by the members of a social system. The barriers to the decentralization of
a society are directly related to the limits placed on the use of the communications technologies. Limitations based on the power or social level of an individual tend to create a centralized society, isolating groups of people from each other.

Concerns-Based Adoption Model

This section of the literature review will focus on the various aspects of the Concerns-Based Adoption Model and its role in staff development. The section will describe:

- The Concerns-Based Adoption Model
- The Stages of Concern Questionnaire (SoCQ)
- The change process
- Implications for staff development
- Research studies involving the Concerns-Based Adoption Model

The Concerns-Based Adoption Model

Educational research and actual adoption practices concerning new innovations in the 1970s led to the development of the Concerns-Based Adoption Model (CBAM) at the University of Texas Research and Development Center for Teacher Education (Hall and Rutherford, 1983). According to Hall (1977) and Hord et al. (1987), several assumptions form the basis for the CBAM. These include:

- The individual is the focal point for concerns-based implementation and effects research.
• The implementation or adoption procedure must be viewed as a process and not a specific event in time.

• During this process, various levels of development can be analyzed and identified.

• The user perceived characteristics of the innovation are critical to the success of implementation efforts.

• School-level variables such as the environment and support, do make a difference.

• The process of implementation or adoption must take place within a larger setting, such as a school building or district. It is a systematic process.

• Implementation of an innovation is an adaptive, interactive, ongoing process.

Hall (1977) points out that various aspects of these assumptions about the CBAM lead researchers to evaluate the implementation process carefully. Hall (1977) suggests that several questions should be asked in order to correctly evaluate the implementation process.

(a) What is it? Due to the individualization aspect of the CBAM, researchers and participants need a clear definition of what the innovation is. This needs to be addressed from both the developer and user point of view.

(b) Does everyone use it the same way? The adaptability of an innovation forces the researcher to properly analyze the variance found in participant usage. Factors affecting the adaptation of the innovation and its level of use include years of experience, level of support provided, and the perceived positiveness of the innovation.
(c) Does the use of the innovation change over time? Expecting all individuals to progress through all stages of use in sequence over a set period of time is impractical. Some individuals remain at various levels of use longer than others or may reach a particular level of use and make no further moves.

(d) What shape is it in? Individuals will be more likely to use an innovation that can be adapted to fit their needs and environment. Part of the evaluation process must include a determination of how the innovation has been adapted. Research by Hall (1977) has found that teachers will structure, organize, and adapt an innovation based on their definitions and hand-holds they have developed concerning the innovation.

(e) What is the innovation like across teachers within the same unit? Because of this individualized mutating of an innovation, a comparison of various forms or configurations of the innovation within a unit must be performed. A unit in this sense may be a common building or work group.

The Stages of Concern Questionnaire (SoCQ)

The SoCQ was developed in 1973 by Hall, Wallace, and Dossett. This instrument makes an assessment of seven hypothesized Stages of Concern (SoC) about an innovation. Hall and Hord (1987) state that participants in the staff development process undergo a series of developmental changes as the experience and skill in using an innovation changes. The stages cover various periods of time ranging from little awareness of the innovation, various levels of use, and planning for its replacement. The change pattern exhibited by individuals does not follow a prescribed sequence or pattern, or necessarily lead to adoption.
The SoCQ is a 35 item questionnaire that can be applied to any educational innovation. The time required for completion is generally 10-15 minutes. The questionnaire can be scored by hand or by computer. The results are generated in the form of an individual or group profile of the most intense or least intense concerns about the innovation. An analysis of both the group and individual profiles will provide information pertinent to the design of effective staff development programs (Hall, 1977; Rutherford, 1977; Hall and Rutherford, 1983). The hypothesized SoC categories are as follows:

Stage 0  Awareness - little concern about or involvement with the innovation is indicated.

Stage 1  Informational - general awareness of and interest in learning about an innovation.

Stage 2  Personal - uncertainty about the demands of the innovation and his/her inadequacy to meet those demands and his/her role with the innovation.

Stage 3  Management - focus on the processes and tasks of using the innovation and best uses of information and resources.

Stage 4  Consequence - addresses the impact of the innovation on student in the teachers' sphere of influence.

Stage 5  Collaboration - concentration on coordination and cooperation with others regarding use of the innovation.
Stage 6 Refocusing - centers on the exploration of more universal benefits from and alternatives to the innovation (Hall, 1977; Rutherford, 1977; Hall and Rutherford, 1983; Hord 1987).

Hall and Hord (1987) emphasize that facilitators can be more effective and change can be more successful if the "concerns" of teachers are considered. The concerns-based approach emphasizes understanding teacher attitudes and skills so that support activities can be directly related to what teachers perceive they need.

The Change Process

Change is not a distinct event, but rather a process that requires time. Individualization of the process is the focal point of the Concerns-Based Adoption Model. The variations in the level of use, the time required, and ease/difficulties in implementation are individual characteristics of each participant and must be treated as such. Each individual's response to the change is influenced by their own ability to use the innovation and their concerns about it (Hall, 1977; Hall and Rutherford, 1983).

Staff development programs are usually administered by outside consultants, administrators, or trainers referred to by Rogers (1986) as change agents. The manner in which an innovation is implemented by a change agent is a powerful influence on the concerns and level of use on an individual (Hord, et al, 1987; Rutherford, 1977). Hall and Hord (1987) describe change agents according to three broad categories: initiator, manager, or responder.
Initiators are characterized by their use of decisive, long-term goals concerning innovations in their environment. Initiators have a clear vision of what their environment should be like and what appropriate roles each person associated with the environment should fill. Not only do initiators have long range visions concerning the environment, but a strong resolve and belief in these goals is present. The determination exhibited by initiators is evidenced by their exhibition of high expectations of other staff members.

Managers show tendencies of responding to situations or individuals, while initiating actions in support of the change process. A key characteristic is their relationship and rapport with individuals in the program. Due to their sensitivity to the individual, managers are cautious not to place excessive demands on participants. Managers like to have control of the program in every facet of the process. When work is allocated to others, a manager acts in a close monitor role.

Change agents who place emphasis on the personal side of their relationships with participants are referred to as responders. A responder's perception of their primary role is one of maintaining a well running system. The responder acts as the traditional administrator that keeps the teachers content and treats the students well. Making decisions about the program are often delayed due to the responder's sensitivity about the participant's perceptions of the decisions. Short term issues are addressed more readily than long-term issues due to the desire of the responder to please others (Hall and Hord, 1987).

In addition to the influence of the change agent, other support personnel such as counselors and peer assistants cannot be overlooked. Their ability to
interact with the participants to help address concerns can be invaluable in the change process (Hall and Rutherford, 1983).

The job of the change agent is multifaceted. Depending upon the level of use or stage of concern of the individual participant (and the group as a whole), change agents will vary in function to best meet their needs. Among the functions of the change agent are:

- Developing supportive organizational arrangements.
  Includes providing the necessary space, materials, personnel, equipment, developing program guidelines and regulations, acquiring funding, planning and managing the change process.

- Training. This is an ongoing process throughout the change process and includes all personnel that are involved with the program.

- Consultation and Reinforcement. Filling in between regular training sessions to meet specific needs of individuals on a less formal basis. These activities are often referred to as "comfort and caring" or "at-the-elbow assistance."

- Monitoring. The informal collection of data concerning what was happening with an innovation and participant progress. This enables the change agent to remind participants that the innovation is important and requires their attention.
These four intervention categories are considered vital to successful change. The utilization of two more categories depend upon the nature of the innovation and the environment it is to be implemented in. These are:

- **External communication.** The public relations aspect of a program used to inform individuals, external to the change environment, about the innovation in order to gain and maintain their support.

- **Dissemination.** The advertisement of information concerning the program and milestones connected with it in order to provide information that will encourage other potential users to enter and potentially adopt the program (Hord et al., 1987).

The importance of the change agent to the process of change is often overlooked. According to Hord, the simple introduction of an innovation does not guarantee its adoption. The change agent must be an active part of the entire process in order to achieve the highest degree of success.

**Implications for Staff Development**

The use of the CBAM in the staff development process provides for fundamental deviations from previous practices. Hall (1985) identified five major implications of the CBAM in reference to staff development.

1. Teacher education models are structured incorrectly if based on the concerns of preservice teacher education majors. These programs do not address the appropriate questions at the times that are pertinent to the student's
needs. The evolution of the preservice teacher differs markedly from the prescribed programs of many teacher education programs.

2. The pattern exhibited as individuals pass through the stages of concern and the levels of use is not linear. While individuals can progress in a straight linear fashion, it is just as likely that non-movement or regression is possible. The arousal of individual's concerns, lack of continued assessment by the change agent, and a variety of other factors affect each individual's pattern and the resulting upward or downward movements.

3. In preservice environments, programs are affected by the variation in the participant's level of maturity. The types and levels of experience of the participants are directly related to the level of maturity of the individual.

4. The methods and form of the presentations are often overshadowed by emphasis on content-related issues. The manner by which material is presented can have an effect on the increase or decrease in perceived relevance and effectiveness.

5. The concerns approach does not rule out the inclusion of particular content in a program. Negotiation between teacher and teacher educator needs to be conducted to create parity in the content of a presentation. When the content and processes of teaching and teacher education, as
well as the concerns pertaining to the program, are taken into account, it should be possible to package and present an effective program.

The Stages of Concern About the Innovation is a clear identifier of characteristics and learning style trends of individuals. Hall and Hord (1987) suggest that further research about staff development programs that are successful in facilitating a change process will increase that success of teaching and learning in relation to adults.

Research Studies Involving the Concerns-Based Adoption Model

John F. Wedman (1986) used the CBAM to assess teacher's attitudes towards microcomputing in education. Wedman found that prior to course entry, that self-oriented concerns were prevalent in the participants. Interests in the program centered on general characteristics of the innovation and its demands on each individual involved. In addition to the self-oriented findings, nearly 1/3 of the participants showed high intensity concerns in both the information and collaboration stages. Wedman stated that this was characteristic of individuals that had considerable computer experience prior to the program.

Analysis of the post program profiles by Wedman yielded uncharacteristic information as compared to the progressive change suggested by Rutherford (1977). The participants were found to have more intense concerns at the higher stages, bypassing the intermediate stages. The lower level concerns did not change significantly.

Wedman concludes that inservice programs need to oriented around the "self" level concerns of some individuals while the experiences for other
individuals needs to add an "other-oriented" concern category. Wedman goes on to state that the post assessment analysis indicated that individuals were actually showing concerns about multiple aspects of educational computing.

In a second study, Wedman (1986) assessed the concerns of K-12 teachers about educational computing. Four versions of the SoCQ were prepared to assess computer assisted instruction (CAI), computer managed instruction (CMI), interactive video (IV) and word processing (WP). The participants were randomly administered one of the four instruments.

The results of the analysis of group profiles showed that the concerns indicated by the participants did not vary from one application to another. While it could be assumed the data indicates that teacher's concerns about educational computing are the same, the construction of a profile matrix from individual profiles showed otherwise.

The matrix is used to indicate for a given application, which concerns are most intense. Wedman found the following three patterns of interest:

1. The intensity of concerns at the awareness level was lower in CAI than in the other applications.
2. The percentages of various concerns were more widely distributed than in the other applications.
3. The majority of the intense concerns about interactive video were in the awareness stage indicating the relative newness of the innovation in relation to education and the teacher's lack of experience with it.

Wedman's study shows that teacher's concerns do vary dependent upon the application in question. This warrants the classification of educational
computing as an "innovation bundle" or collection of various innovations. An analysis of concerns about various aspects of computer education due to this aspect of educational computing is necessary to correctly assess the concerns. Wedman suggests that inservice programs can at first give the wide picture of general information about an innovation and later focus in on distinct aspects or components of the innovation.

Cicchelli and Baecher's (1987) study focused on the dimensions of the process of change when introducing an innovation in schools and on teacher concerns about using the technology in the classroom. The Stages of Concern (SoCQ) questionnaire was administered to eighteen volunteer teachers. Based on their respective profiles from the instrument, three "users" and three "non-users" were interviewed as to their current projected uses of computers in teaching. A three day inservice created from the collected data produced a significant change in the teachers' concerns towards computers. The SoCQ profiles support the consideration of formal and informal sources of learning. Formal sources such as courses and workshops and informal sources such as contact with computer buffs and time on machines should be examined when developing inservice programs. The study shows a change in teacher concerns towards opportunities for collaboration with peers and specialists on classroom use of computers. Cicchelli and Baecher state a need to explore and test comprehensive staff development projects that are: (1) data-based, (2) personalized, and (3) responsive to the concerns of teachers in order to improve implementation of computers in the educational environment.

The Biological Sciences Curriculum Study (BSCS) is a three year project to develop a model for implementing educational computing in school science.
The project school district was Colorado Springs School District 11 with support provided from the National Science Foundation (NSF), the Pikes Peak Board of Cooperative Services, and a variety of software publishers. The goals of the project included the development and testing of a model of educational computing implementation in school science; the training of 260 staff members and administrators in the use of microcomputers; establishment of a network in the region to implement educational computing in science; and the dissemination of a model for the implementation of educational computing in science.

The evaluation of the second year of the program by project staff involved the use of the Concerns-Based Adoption Model (CBAM). Information required for the evaluation included (1) teacher descriptive data about the innovation and their experiences with it; (2) critiques of the training workshops as perceived by the participants; (3) critiques of the training seminars as perceived by the participants; (4) the stages of concern as assessed by the Stages of Concern about the Innovation segment of the CBAM; and (5) a description of the innovation's use through the use of the Innovation Configuration segment of the CBAM.

Ellis (1989) looked at the SoC ratings provided by the 22 leaders of the BSCS program. Leaders were participants during the first year of the BSCS program and became leaders during the second year. The leaders averaged 14.9 years of experience and nearly 67% held Master's degrees. Over 85% of the leaders rated their experience level with microcomputers as intermediate or higher. The leaders group profile from the Stages of Concern Questionnaire moved in a developmental pattern from that of a non-user to one of a routine user.
The 80 teachers involved in the project for the first time were evaluated in similar manner. Nearly 60% of these teachers held Master's degrees and average 11.6 years of teaching experience. Nearly 75% of the first time participants were classified as non-users or novices at educational computing in school science prior to entering the project. The second year analysis showed that nearly 85% of the teachers were considered users of educational computing in science at the end of training.

Hypermedia

This section of the literature review will look at various aspects of hypermedia and its effect on education. It will provide information that will help determine the necessity of staff development programs concerning hypermedia. The review will discuss:

- Characteristics of hypermedia
- Problems endemic to hypermedia
- Positive attributes of hypermedia in education
- Application of hypermedia to educational settings.

Characteristics of Hypermedia

Hypermedia-based applications share several characteristics:

- High levels of interactivity.
- Integrates a variety of media forms.
- Use of node and link structures.
- Allows the user to be information selective.
- Adaptable to student needs and capabilities.
Hypermedia is an application of technology that enables a user to interact with a variety of integrated tools known as multimedia. Multimedia is a collection of software and hardware that can include CD-ROM, laserdisk, video, sound, text, and graphics controlled by a computer (Trotter, 1989; Heller, 1990; Byrom, 1990; Blanchard and Rottenberg, 1990). Interactivity is described by Rogers (1986) as "the capability of new communications systems to 'talk back' to the user." The degree of the interactivity depends on three factors. The (1) type of technology being used, (2) the user, and (3) the context of the use combine to produce the degree of interactivity present in an innovation. Heller (ibid) differentiates Hypermedia Assisted Instruction (HAI) from Computer Assisted Instruction (CAI) by its use of multimedia and its node and link structure. Heller states that "while the traditional forms of CAI—drill and practice, tutorials, simulations, and games—may all be presented using HAI, typically HAI ... are rich environments for student directed investigation."

Hypermedia programs allow the user to selectively group pertinent information in chunks or nodes. These nodes can then be linked together through the use of "buttons." By using "buttons" a user can browse through the information contained in the program, choosing the direction and breadth of their travel (Trotter, 1989).

Trotter states that hypermedia has the potential to help teachers adapt instructional materials to the student's needs and restructure the existing focus of control in the classroom. It allows the teacher the freedom to put control of learning in the student's hands and giving the learner a variety of media from which to approach the learning process.
A variety of hypermedia applications are available to educators at all levels. Due to the extreme demand for hypermedia tools by educators and hardware developers, many software companies are producing hypermedia applications for all levels of education (McCarthy, 1989).

**Problems Endemic in Hypermedia Usage**

Hypermedia is not unlike other technological innovations in that a variety of problems exist that impede its use. These problems include:

- Lack of administrative/teacher ability and/or commitment.
- Need for new instructional strategies.
- Disorientation.
- Cognitive overload.
- Teacher management of the hypermedia environment.

The current uses of computers in education predominantly fall into the areas of Drill and Practice and Tutorials (Bush & Cobb, 1984; Becker, 1987). Due to this factor, a great preponderance of the research reflects these trends. The essential questions about computer or technology usage such as "Are computers improving performance in basic skills?," "What skills will be most affected?," "What kinds of students are most affected?," and many others are being asked, but about existing applications such as those previously mentioned (Robyler, 1988). At the present, the instructional impact of computer technology is being severely limited by the lack of teacher ability and commitment to altering existing paradigms (Wedman and Heller, 1984).
According to Marchionini (1988), users of hypermedia will require new strategies for making the best use of their time and effort. These cognitive and physical challenges require careful examination by designers and users in all fields. Marchionini states that problems associated with hypermedia are classified in three major areas: hypermedia literacy, the hypermedia learning environment, and the hypermedia teaching environment. The problems of the teaching environment evolve from the first and second problems.

In order to become a hypermedia user the teacher must address four primary areas of concern:

1. The principles involved in creating exemplary hyperdocuments.
3. Creating assignments and activities.
4. Evaluating materials and learning.

Heller (1990) and Conklin (1987) state that several problems are endemic to the use of hypermedia. These are such things as disorientation and cognitive overload. Disorientation is stated as a two dimensional problem concerned with not only knowing where you are at in the application, but knowing how to get somewhere else. This difficulty is partially caused by the lack of perception of the application's size. This is a design problem the designer must address. Cognitive overload can be caused by the richness of the information and perspectives supplied the user. These problems contribute to difficulties in maintaining a user's commitment to the system.
Positive Attributes of Hypermedia Use in Education

Hypermedia inherently contains many attributes that positively influence the transfer of knowledge. These characteristics include the following:

- Increased incidental learning.
- Maintaining student's focus.
- The degree of user control.
- Environmental adaptability.
- Change in student's perception of the learning process.

Heller (1990) states that these characteristics include maintaining the learner's locus of control and the invisibility of a system's objectives which lead to incidental learning. The integration of the various forms of media allow the user to review information in a variety of ways. The user has control over the choice of which medium or media to use (Heller, 1990; Trotter, 1989; Blanchard and Rottenberg, 1990). The use of properly designed hypermedia productions has the capability to change a student's means and views of learning (Blanchard and Rottenberg, 1990).

Hypermedia Applications in Education

A study conducted by Horton, Boone and Lovitt (1990) tested the effectiveness of HyperCard as a study guide for four LD classified secondary students in social studies. The purpose of the experiment was to extend previous CAI based research through the usage of hypertext. The key was the non-linear fashion in which learning could take place.

Each student was provided the use of a Macintosh SE computer using a self-paced HyperCard-based application designed by Boone. The instructions
were located at the top and bottom of the screen. The application was divided into two parts - a reading segment and a question segment. The linkages provided by HyperCard allowed the following sequence to be prepared: text, question, response, consequence, overall sequence.

The results of the HAI were measured with six multiple-choice tests. These consisted of a pretest, a posttest, a retention test, and three individual lesson tests. The results showed:

• A significant difference on computer items between pretest and posttest.
• A significant difference on computer items between pretest and retention test.
• No significant difference on computer items between posttest and retention test.
• No significant difference on control items (those appearing on the test, but not on the computer program) across pre, post and retention tests.
• No significant differences for computer or control items across the individual lesson tests.

Learning disabled students acquired proficiency with the computer program during the first hypertext session and averaged nearly perfect performance on computer generated questions. The program embodied features in its design that have been proven effective in other CAI studies. These include:

• self-pacing
• frequent responding
• correction, feedback
• sequenced instruction
• use of small teaching sets and computer-based testing
• mouse controlled response
• use of simple directions

The HyperCard program provided the hypertext dimension of non-linearity for the complex linkage required in the application.

The Florida Department of Education supports technology education through the funding of four Instructional Computing Centers (Barron and Baumbach, 1990). The Department of Education conducted a survey concerned with the instructional use of CD-ROM technologies among the four Instructional Computing Centers in 1985.

The survey revealed that CD-ROM was being used in the following ways:
(1) at the district level for assisting with media acquisition and processing,
(2) lesson storage for integrated learning systems, and (3) research and reference.

The Department of Education determined that the dispersal of information and staff training were necessary to implement the use of CD-ROM technologies throughout the schools. This was to be accomplished through the production of a computer-based education (CBE) program. This CD-ROM based tutorial was chosen because of its characteristics that allow for individualized control of the pace and sequence, and immediate feedback. The program was designed to be used at the seventh grade and above, addressing the issues of defining what CD-ROM is and how it operates, describing how to search for information, demonstrations and descriptions of CD-ROM applications, and providing information about CD-ROM technologies. These topics were used as the major categories of the tutorial's menu and were labeled as: (1) Overview, (2) Search, (3) Grolier Encyclopedia, and (4) Applications.
The application was produced using the TenCORE Authoring Language for the MS-DOS version, HyperCard for the Macintosh version, and the Tutor Tech Authoring System for the Apple II version.

The evaluation of the program was performed by students from the University of Central Florida using a twenty item, criterion-based pretest and posttest. Barron and Baumbach report that there was a significant difference between the pretest and posttest scores of the experimental group. Using graphic displays of the mean achievement levels of the control and experimental groups, it was determined that the program was effective. The evaluation showed that 95% of the students enjoyed the program. Typical comments included being able to go back and review, the user-friendliness, self paced sequencing, and hands on capabilities. The Overview and Simulation sections were the most popular while the Applications section was liked the least.
CHAPTER III. METHODS

This chapter describes the methods used to answer the research questions. Also described are the subjects, test instruments, research design, research procedures, limitations, and data analysis. An attempt is being made to identify and describe the concerns, attitudes, and knowledge retention of the participants in reference to an innovation - hypermedia. Statistical analysis of the data will provide information concerning: (1) relationships among the independent and dependent variables of the study and (2) degree of differentiation of the pre and posttest results. Information relating to the development and execution of this study will be described in the following sections.

Subjects

Subjects of this study included 17 graduate students who participated in the course Curr 593B - "Hypermedia Workshop" at Iowa State University, Ames, Iowa during the summer session of 1991. The subjects varied in age, gender, education level, hypermedia experience, teaching experience, and grade levels they taught.

Test Instruments

Four instruments were administered during the study. The instruments (see Appendix B) consisted of the following:

- Two sections of the Iowa Survey of Computer Related Technology Use by K-12 Teachers (ISCRT, Iowa Department of Education, 1991):
  - Demographic
- Participant Attitude in Relation to Technology Usage

- The Stages of Concerns About the Innovation Questionnaire (SoCQ) (R&D Center for Teacher Education, 1974)

- The Hypermedia Knowledge Test (HKT) (Dept. of Curriculum and Instruction, Iowa State University, 1991)

- Hypermedia Usage Questionnaire (HUQ)

The Stages of Concern Questionnaire (SoCQ)

The SoCQ was developed in 1973 by Hall, Wallace, and Dossett. This instrument makes an assessment of seven hypothesized Stages of Concern or SoC about an innovation. Hall and Hord (1987) state that participants in the staff development process undergo a series of developmental changes as the experience and skill in using an innovation changes. The stages cover various periods of time that range from little awareness of the innovation, various levels of use of the innovation, and planning for replacement if the innovation. The change pattern exhibited by individuals does not follow a prescribed sequence or pattern, and does not necessarily lead to adoption.

The SoCQ is a 35 item questionnaire that can be applied to any educational innovation. The time required for completion is generally 10-15 minutes. The questionnaire can be scored by hand or by computer. The results are generated in the form of an individual or group profile of the most intense or least intense concerns about the innovation. An analysis of both the group and individual profiles will provide information pertinent to the design of effective staff development programs (Hall, 1977; Rutherford, 1977; Hall and Rutherford, 1983).
A reliability study was conducted in September 1974. Using a total of 132 professors and classroom teachers, the test-retest correlation produced results ranging from 0.65 to 0.86 and the estimates of internal consistency (alpha coefficients) range from 0.80 to 0.93 (Rutherford, 1977).

**HyperMedia Knowledge Test.**

The Hypermedia Knowledge Test is an instrument designed to measure the level of cognitive knowledge concerning hypermedia concepts and skills. The construction of the test was administered by Dennis McElroy, Dr. Roger Volker, Dr. Michael Simonson, and Dr. E. Ann Thompson (see Appendix A). As a measure of the test's validity, the test was constructed under the advisement and collaboration of a team of experts in the field of educational applications of technology. The team consisted of 3 graduate students, 3 professors, 1 Area Education Agency consultant, and 9 educators that had previously participated in hypermedia coursework. Initially, a list of topics concerning hypermedia was produced. This list of topics was compiled and reduced to four major content areas. The objectives of the university workshop were then categorized according to the applicable content area.

The panel of experts was randomly divided into three groups to develop questions based on the objectives. The three groups focused on two assigned content areas. Group one focused on area one and four; group two focused on area two and four; group three focused on area three and four. Area four was repeated throughout due to the large number of objectives associated with the content area. The questions submitted by the panel of experts were classified according to content area and objective.
The compiled list of questions and related objectives were resubmitted to the panel of experts. The instrument items were compared to the topic objectives and rated on a five point Likert scale for objective validity. Questions with ratings below three on the Likert scale were dropped or revised according to recommendations from the administrative team.

The final list of questions was randomly divided in order to create the first draft of the HKT. Again, Likert scales were used to measure the validity of the questions. Questions that were returned with ratings of three or below were revised or deleted according to recommendations from the administrative team.

The second draft of the HKT was prepared containing the recommended changes. The test was resubmitted to the panel of experts for suggestions and comments. The list of suggestions and comments was evaluated by the administrative team and final revisions were recommended.

The final draft of the HKT was prepared from the list of recommendations made by the administrative team. The HKT was tested for reliability using the test-retest method. Twenty students from a single section of Sec Ed 101, "Introduction to Microcomputers" were administered the test. The students were informed that the test was being administered on a voluntary basis and that it would have no bearing on their class grade. Any member could refuse to take the test with no penalty. One week later, the test was administered for the second time. The test-retest correlation results ranged from 0.69 to 0.81 and the estimates of internal consistency as determined by SPSS (alpha coefficients) range from 0.80 to 0.93.
The Iowa Survey of Computer Related Technology Use by K-12 Teachers

This instrument was developed by the Iowa State University College of Education and State of Iowa Department of Education. Two sections (Demographic and Participant Attitude in Relation to Technology Usage) of the Iowa Survey of Computer Related Technology Use by K-12 Teachers (ISCRT, Iowa Department of Education, 1991) were used. The instrument supplies basic demographic and attitudinal information about each of the participants. The attitudinal section of the ISCRT was found to contain three factors through the use of the SPSS Factor Analysis routine. Reliability of the attitudes section of the ISCRT was assessed by applying the Cronbach coefficient alpha procedure to each of the three factors. The reliability of the General Attitudes factor was .90; the Confidence factor was .87; and the Necessity factor was .77 (Schmidt, 1991).

Hypermedia Usage Questionnaire

The Hypermedia Usage Questionnaire was written by the researcher to assess the participant's degree of usage and factors affecting that usage. It consists of three sections containing a total of twenty-four questions: (1) Hypermedia Usage (2) Support Mechanisms and (3) Demographics. Sections one through three contain fourteen questions, seven questions, and three questions, respectively. The questionnaire rates the type of use, level of use, level of diffusion efforts, impediments to usage and diffusion, types and levels of support mechanisms, and school district demographics.
Research Design

This study is descriptive in nature. It includes three measurements assessing cognitive knowledge, concerns about the innovation, attitudes and usage levels of graduate students over a four month period.

Procedures

The research proposal for this study was reviewed and approved by the Iowa State University Human Subjects Committee. The initial segment of the study was carried out during a university workshop involving research on hypermedia and its role in education, hypermedia usage, and hypermedia development. This workshop consisted of ten three hour sessions held over a period of twelve days in June 1991. The final segment of the study was carried out during the final two weeks of September 1991.

The study consisted of a package of four instruments measuring:

- participant attitude toward technology
- participant concerns about the technology
- participant level of knowledge about hypermedia
- participant level of use of hypermedia

The surveys were given prior to instruction, immediately after the workshop, and one month after the participants returned to work. The initial demographic material obtained from the initial ISCRT instrument was not included in later administrations. The Hypermedia Usage Questionnaire was administered during the final assessment only. The instruments were administered as outlined in Table 1.
Table 1. Administration of survey instruments.

<table>
<thead>
<tr>
<th>Stages of Concern Questionnaire</th>
<th>Iowa Survey of Computer-Related Technologies</th>
<th>Hypermedia Knowledge Test</th>
<th>Hypermedia Usage Questionnaire</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Posttest 1</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Posttest 2</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

Course Design

The course was organized into three basic components. (1) Reference to current research in the area of hypermedia application in education. Current literature was assigned to be read prior to each meeting. Approximately one hour per meeting was spent reviewing and discussing the assigned research articles. (2) Instruction in the use of the components of hypermedia (equipment and software). Access to a variety of hypermedia technology was made available to the participants. MS-DOS, Macintosh, and Apple II series hardware and software were available for participant use. The hardware included computers, scanners, CD-ROM, video or laserdisk, Xapshot, and video tape equipment. (3) Proper hypermedia development techniques. Discussion focused on the various negative and positive attributes of hypermedia and how to apply or avoid them during the design and construction of hypermedia based instruction packages.

Hypermedia instruction and development constituted the bulk of the course. Approximately two hours per day were spent on this topical area. Hands
participants were given the task of designing and building a hypermedia application applicable to their area of expertise. The participants were encouraged to work in groups of common interest. The final two days of the workshop were spent sharing, reviewing, and discussing the variety of projects constructed by the participants.

Support Mechanisms

Upon conclusion of the workshop, a variety of participant support mechanisms were put into place. The use of an electronic bulletin board system located at Iowa State University was made available. The bulletin board system supplied participants with a cost-free method of communication and idea exchange. A limitation of this system was a lack of electronic communication devices (modems) and/or computers available to some of the participants. Direct phone access to the instructors and teaching assistant of the workshop was established. The work (and home in some cases) numbers of these individuals were supplied to the participants. A third method of support was the issuance of a newsletter containing information pertaining to hypermedia. The development of staff in each of the participant's work places was suggested as a method of establishing a local support cadre.
Analysis of Data

This section contains information related to the procedures used to analyze each of the test instruments.

**Stages of Concerns Questionnaire**

Scoring of the questionnaire was accomplished by using a spreadsheet template for recording and displaying the information in a useful format. Each of the thirty-five statements are recorded for each individual. Each statement of concern was scored in a range of 0 to 7 by the subject. High numbers indicate high concerns, low numbers low concern, and 0 indicative of extremely low concerns or irrelevancy.

Scores from each of the questions are considered raw scores. Each of these scores are converted to percentiles in the spreadsheet. The percentiles are based on the responses of the 646 individuals used in an initial validity study in 1975 (Hall, George, and Rutherford, 1986). The reference percentiles upon which the calculation is made are representative of other innovations. The percentile scores are displayed on a line graph representing the levels of concern for each stage. Additional descriptive information was provided through the use of the SPSS Descriptives routine.

The use of the Profile Interpretation was used to provide a detailed picture of the individual concerns. Hypothetically, the individual will progress from Stages 0, 1, and 2 to Stage 3, and then to Stages 4, 5, and 6 as individuals move from unawareness and nonuse into beginning and more sophisticated use of the innovation if the innovation is viewed as positive and appropriate support
mechanisms are used. According to Hall, George, and Rutherford (p. 34, 1986) the Profile Interpretation is the "most complete clinical interpretation and assessment of both individual and group data."

Information concerning typical profiles and rules for interpretation found in the Profile Interpretation section of the Measuring Stages of Concern About the Innovation: A Manual for Use of the SoC Questionnaire (Hall, George, and Rutherford, 1986) was used to produce the individual and group profile statements.

**Participant's Cognitive Knowledge**

The Hypermedia Knowledge Test (HKT) consists of forty-seven multiple choice questions. The SPSS t-test procedure was used to analyze data from the HKT to determine any changes in cognitive knowledge that might have taken place during the four month period. The alpha was set at .10 due to the descriptive nature of the study.

**Participant's Attitudes Concerning Technology**

The twenty-three items on the questionnaire were answered using a Likert scale. The scale for these items was as follows: 1 = Strongly Disagree; 2 = Disagree; 3 = Undecided; 4 = Agree; 5 = Strongly Agree. The results of a Factor Analysis of data collected from the survey conducted by the State of Iowa and Iowa State University indicated that three attitudinal factors existed. These factors were: (1) General attitudes toward computer-related technologies, (2) Confidence in using computer-related technologies, and (3) Attitudes about the necessity of using computer-related technologies in education (Schmidt,
The factors from the State of Iowa survey were applied to this study for comparative analysis purposes. Reverse scoring was used prior to analyzing the data to compensate for attitudinal items that were worded negatively (i.e. 1=5, 2=4, 4=2, and 5=1). The nine item numbers that were reversed scored were 1, 4, 5, 7, 11, 17, 18, 19, and 22. The level of change for each factor was analyzed by applying the SPSS t-test procedure to the cumulative factor score of each individual's data and of the entire group. An alpha of .10 was used during the pre/post comparison. The individual results of the K-12 participants were compared with the State of Iowa results to assess any differences between the study participants and the average teacher in the State of Iowa.

**Participant's Hypermedia Usage**

The Hypermedia Usage Questionnaire consists of twenty-four statements concerning participant usage, support, and work demographics. The SPSS Frequencies procedure was used to provide information pertaining to the number of users, level of use, rating of the various impedimentary factors, and the level of support received from various areas.

**Participant Demographic Characteristics**

The demographic information was provided the demographic section of the ISCRT attitudinal questionnaire. Three variables were chosen for analysis. These variables were: (1) gender, (2) teaching level, and (3) education. Each variable was broken into two distinct levels. They were:

<table>
<thead>
<tr>
<th>Gender</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teaching Level</td>
<td>K-8</td>
<td>9-post secondary</td>
</tr>
<tr>
<td>Education</td>
<td>BS/BA</td>
<td>MS/MA or above</td>
</tr>
</tbody>
</table>
A t-test was used to compare the levels of gender, teaching level, and level of education to provide information concerning any differences for the HKT results and attitudinal factors. An alpha of .10 was used for these tests.

Limitations of the Study

Several uncontrolled variables contribute to the limitations of the study. First, the lack of a control group with which to compare subject's test scores and the lack of control over the environmental conditions of the final test administration made it impossible to control for any maturation or unstable instrumentation effects. Also, the researcher could not control the degree to which the subjects practiced using the innovation during the four month period of the study. The small sample size \((N = 17)\) and the use of only one workshop group for analysis limits the generalizability of the results of this study.

Administration of the pretest raises the possibility of sensitization of the participants to the subject matter. Also, interpretation of the Stages of Concern About the Innovation Questionnaire results must be made with caution. The genuineness of the responses, the goodness of the measure, and the skill of the interpreter all have an effect on the accuracy of the profile statements. If the results of the SoCQ are used to develop a staff development program certain precautions must be taken. Of greatest importance is confirming the profile interpretation with the individual in question. A personal interview often is necessary to provide additional information that can be used for this purpose. Comparison with the demographic data can also aid the interpreter in determining the cause and strength of the concerns.
CHAPTER IV. RESULTS

The results of the findings in relationship to each of the three research questions found in Chapter 1 will be discussed in this chapter.

Teacher Attitudes Toward Computer-Related Technologies

Research Question 1: Will the participant's attitudes concerning the use of technology in education, as measured by the attitudinal section of the The Iowa Survey of Computer Related Technology Use by K-12 Teachers (ISCRT), change during the initial stages of the innovation adoption process?

This question was divided into four sections. Sections one through three are based on a factor analysis of the Iowa survey instrument. The four sections are as follows:

1. General attitude toward computer-related technologies.
   (questions 3, 6, 8, 12-16, 21, 23)
2. Confidence in using computer-related technologies.
   (questions 1-4, 7, 9, 16, 17)
3. Attitude toward the necessity of computer-related technologies in education. (questions 5, 10, 11, 18, 19, 22)
4. Analysis of sections one through three based on the demographic characteristics of the participants.
Section 1: General Attitudes Toward Computer-Related Technologies

Finding: There was no significant difference in the pre and post general attitudes toward computer-related technologies.

Figure 1 shows the pre/post responses to the general attitudes about computer-related technologies factor. The average response to the general

![Survey Question Bar Chart]

Survey Question

3 I think computers make work more enjoyable.
6 Computer-related technologies are an important part of the future for improving the quality of education.
8 I would like to improve my skills in the use of computer-related technologies.
12 Computers are valuable tools that can be used to improve the quality of education.
13 Computer-related technologies should be used to improve learning throughout the curriculum.
14 Computers are useful for teaching thinking and problem solving skills.
15 Computer-related technologies should be used by teachers more than they are now.
16 My teaching is positively affected when using computer-related technologies.

Figure 1. Pretest and Posttest question means for the general attitudes towards computer-related technologies factor.
attitudes factor was 4.57 on the pretest and 4.55 on the posttest. This is slightly above the midpoint between agree and strongly agree on the 5 point scale. Statements that provided the most positive responses to both the pre and posttest results were "Computer-related technologies are an important part of the future for improving the quality of education" ($\bar{X}_1= 4.88, \bar{X}_2= 4.77$), "Computers are valuable tools that can be used to improve the quality of education" ($\bar{X}_1= 4.77, \bar{X}_2= 4.88$) and "Computer-related technologies should be used to improve learning throughout the curriculum" ($\bar{X}_1= 4.65, \bar{X}_2= 4.71$). The lowest means of any pre and posttest item for this factor were for the statements "I think computers make work more enjoyable" ($\bar{X}_1= 4.12, \bar{X}_2= 4.12$) and "My teaching is positively affected when using computer-related technologies" ($\bar{X}_1= 4.12, \bar{X}_2= 4.18$). Both statements means are slightly above agree on the five point scale. Table 2 shows that there is no significant difference between the pre— and posttest responses for the general attitudes factor.

Table 2. Descriptive statistics and t-test for general attitudes towards computer-related technologies factor pretest and posttest.

<table>
<thead>
<tr>
<th>Test</th>
<th>N</th>
<th>Mean</th>
<th>S.D.</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td>17</td>
<td>4.57</td>
<td>.39</td>
<td>.82</td>
</tr>
<tr>
<td>Posttest</td>
<td>17</td>
<td>4.55</td>
<td>.29</td>
<td></td>
</tr>
</tbody>
</table>

$p<.10.$
t-test indicates no significant difference between tests.
Section 2: Confidence in Using Computer-Related Technologies

Finding: There is no significant difference in the pre and post confidence in using computer-related technologies factor.

Figure 2 shows the pre/post responses to the confidence in using computer-related technologies factor. The confidence factor had an average response of 3.85 on the pretest and 3.92 on the posttest. The means for both administrations are slightly below agree on the five point scale. The statement

![Survey Question Bar Chart]

1. I think that computers make my professional work easier.
2. I am comfortable in using computer-related technologies for my own work.
3. I think computers make work more enjoyable.
4. It has been easy for me to learn how to use a computer successfully.
7. I have confidence in using a computer to complete my work.
9. I don't feel threatened by computers.
16. My teaching is positively affected when using computer-related technologies.
17. I feel comfortable using computer-related technologies in my teaching.

Figure 2. Pretest and Posttest question means for the confidence in using computer-related technologies factor.
that had the most positive response was "I think that computers make my professional work easier" ($X_1=4.59$, $X_2=4.35$). The means for this statement are between agree and strongly agree. The lowest response of any individual item for this factor was "I have confidence in using a computer to complete my work" ($X_1=2.06$, $X_2=1.89$). Several other statements scored positively for this factor, including "I think computers make work more enjoyable" ($X_1=4.19$, $X_2=4.19$), "I don't feel threatened by computers" ($X_1=4.19$, $X_2=4.29$), and "I feel comfortable using computer-related technologies in my teaching" ($X_1=4.19$, $X_2=4.24$). There was found to be no significant difference between the pre and posttest responses for the confidence factor (Table 3).

Table 3. Descriptive statistics and t-test for participant's confidence towards using computer-related technologies factor pretest and posttest.

<table>
<thead>
<tr>
<th>Test</th>
<th>N</th>
<th>Mean</th>
<th>S.D.</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td>17</td>
<td>3.85</td>
<td>.53</td>
<td>.48</td>
</tr>
<tr>
<td>Posttest</td>
<td>17</td>
<td>3.92</td>
<td>.47</td>
<td></td>
</tr>
</tbody>
</table>

$p<.10$.

T-test indicates no significant difference between tests.

Section 3: Attitudes About the Necessity of Using Computer-Related Technologies in Education

Findings: There was a significant difference between the pre and post attitudes about the necessity of using computer-related technologies in education factor.

Figure 3 shows the pre/post responses to the participant attitudes about the necessity of using computer-related technologies in education. Participant responses concerning attitudes about the necessity of using computer-related
technologies in education had a pretest mean of 4.63 and a posttest mean of 4.84.
The group means for this factor are slightly below strongly agree on the five

| Strongly Agree | 5 |
| Agree          | 4 |
| Undecided      | 3 |
| Disagree       | 2 |
| Strongly Disagree | 0 |

Survey Question

5 Teachers need to know how to use a computer.
10 The computer is useful for accessing and organizing information.
18 Computer-related technologies are necessary luxuries in most school settings.
19 Computers are of value in education because they can be used to help teach several subjects.
22 Computer-related technologies are of value in the classroom because they are not difficult to use.

Figure 3. Pretest and Posttest question means for the attitudes about the necessity of using computer-related technologies in education factor.

point scale. Individual statements that had the highest positive responses included "The computer is useful for accessing and organizing information" ($\overline{X}_1=4.82$, $\overline{X}_2=4.77$) and "Word processing makes writing easier" ($\overline{X}_1=4.82$, $\overline{X}_2=4.77$). Other statements for this factor showed high positive scores. These
include "Computer-related technologies are necessary luxuries in most school settings" ($\bar{X}_1=4.65, \bar{X}_2=4.77$), "Computers are of value in education because they can be used to teach several subjects" ($\bar{X}_1=4.71, \bar{X}_2=4.94$), and "Computer-related technologies are of value in the classroom because they are easy to use" ($\bar{X}_1=4.53, \bar{X}_2=4.71$). The lowest response to any individual item for this factor was "Teachers need to know how to use a computer" ($\bar{X}_1=4.24, \bar{X}_2=4.59$). The average response to this item is still well above agree. Table 4 shows that there was a significant difference between the pretest and posttest means for this factor.

Table 4. Descriptive statistics and t-test for participant's attitude toward the necessity of computer-related technologies in education factor pretest and posttest.

<table>
<thead>
<tr>
<th>Test</th>
<th>N</th>
<th>Mean</th>
<th>S.D.</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td>17</td>
<td>4.63</td>
<td>.39</td>
<td>.02*</td>
</tr>
<tr>
<td>Posttest</td>
<td>17</td>
<td>4.84</td>
<td>.37</td>
<td></td>
</tr>
</tbody>
</table>

$p<.10$.
t-test indicates there is a significant difference between tests at .10.

Section 4: Demographic Characteristics and Attitude Responses.

Findings: There was no significant difference between the pre and post general attitudes about computer-related technologies based on the demographic variables.

Three demographic characteristics of the participants were analyzed to assess attitudinal differences. These characteristics were gender, level of education (Bachelors degree v. Masters/PhD), and teaching level (K-8 v. 9-post
secondary). A t-test was conducted on each demographic variable for each test and factor. No significant differences were found based on the demographic variables. Tables 5 through 7 show the pre/post average attitudinal responses of the participants based on the three demographic variables. Table 8 shows the average individual question responses for the pretest, posttest, and State of Iowa survey.

Table 5. Descriptive statistics and t-tests for pretest and posttest general attitudes about computer-related technologies based on gender, education, and teaching level.

<table>
<thead>
<tr>
<th>Test</th>
<th>Variable</th>
<th>N</th>
<th>Mean</th>
<th>S.D.</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td>Male</td>
<td>3</td>
<td>4.10</td>
<td>.27</td>
<td>.02</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>14</td>
<td>4.67</td>
<td>.34</td>
<td></td>
</tr>
<tr>
<td>Posttest</td>
<td>Male</td>
<td>3</td>
<td>4.40</td>
<td>.17</td>
<td>.33</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>14</td>
<td>4.58</td>
<td>.30</td>
<td></td>
</tr>
<tr>
<td>Pretest</td>
<td>K-8</td>
<td>10</td>
<td>4.57</td>
<td>.43</td>
<td>.99</td>
</tr>
<tr>
<td></td>
<td>9-post sec.</td>
<td>7</td>
<td>4.57</td>
<td>.36</td>
<td></td>
</tr>
<tr>
<td>Posttest</td>
<td>K-8</td>
<td>10</td>
<td>4.62</td>
<td>.28</td>
<td>.26</td>
</tr>
<tr>
<td></td>
<td>9-post sec.</td>
<td>7</td>
<td>4.46</td>
<td>.29</td>
<td></td>
</tr>
<tr>
<td>Pretest</td>
<td>BS/BA</td>
<td>7</td>
<td>4.46</td>
<td>.45</td>
<td>.33</td>
</tr>
<tr>
<td></td>
<td>MS+</td>
<td>10</td>
<td>4.65</td>
<td>.35</td>
<td></td>
</tr>
<tr>
<td>Posttest</td>
<td>BS/BA</td>
<td>7</td>
<td>4.49</td>
<td>.25</td>
<td>.43</td>
</tr>
<tr>
<td></td>
<td>MS+</td>
<td>10</td>
<td>4.60</td>
<td>.31</td>
<td></td>
</tr>
</tbody>
</table>

p<.10.
t-test indicates there is no significant difference between males and females for general attitudes about computer-related technologies at .10. Pretest result was called insignificant due to the limited N and male/female ratio.
Table 6. Descriptive statistics and t-tests for participant’s pretest and posttest confidence towards using computer-related technologies based on gender, level of education, and teaching level.

<table>
<thead>
<tr>
<th>Test</th>
<th>Variable</th>
<th>N</th>
<th>Mean</th>
<th>S.D.</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td>Male</td>
<td>17</td>
<td>3.63</td>
<td>.54</td>
<td>.44</td>
</tr>
<tr>
<td>Pretest</td>
<td>Female</td>
<td>3.90</td>
<td>.53</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Posttest</td>
<td>Male</td>
<td>4.00</td>
<td>.33</td>
<td>.75</td>
<td></td>
</tr>
<tr>
<td>Posttest</td>
<td>Female</td>
<td>3.90</td>
<td>.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pretest</td>
<td>K-8</td>
<td>3.74</td>
<td>.57</td>
<td>.33</td>
<td></td>
</tr>
<tr>
<td>Pretest</td>
<td>9-post sec.</td>
<td>4.00</td>
<td>.46</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Posttest</td>
<td>K-8</td>
<td>3.90</td>
<td>.58</td>
<td>.85</td>
<td></td>
</tr>
<tr>
<td>Posttest</td>
<td>9-post sec.</td>
<td>3.95</td>
<td>.31</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pretest</td>
<td>BS/BA</td>
<td>3.70</td>
<td>.46</td>
<td>.35</td>
<td></td>
</tr>
<tr>
<td>Pretest</td>
<td>MS+</td>
<td>3.95</td>
<td>.57</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Posttest</td>
<td>BS/BA</td>
<td>3.84</td>
<td>.28</td>
<td>.57</td>
<td></td>
</tr>
<tr>
<td>Posttest</td>
<td>MS+</td>
<td>3.98</td>
<td>.58</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

p<.10.
t-test indicates no significant difference between demographic variables concerning confidence towards using computer-related technologies at .10.

Table 7. Descriptive statistics and t-tests for participant’s attitudes about the necessity of using computer-related technologies in education based on gender, level of education, and teaching level.

<table>
<thead>
<tr>
<th>Test</th>
<th>Variable</th>
<th>N</th>
<th>Mean</th>
<th>S.D.</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td>Male</td>
<td>3</td>
<td>4.55</td>
<td>.25</td>
<td>.74</td>
</tr>
<tr>
<td>Pretest</td>
<td>Female</td>
<td>14</td>
<td>4.64</td>
<td>.42</td>
<td></td>
</tr>
<tr>
<td>Posttest</td>
<td>Male</td>
<td>3</td>
<td>4.78</td>
<td>.39</td>
<td>.87</td>
</tr>
<tr>
<td>Posttest</td>
<td>Female</td>
<td>14</td>
<td>4.81</td>
<td>.30</td>
<td></td>
</tr>
<tr>
<td>Pretest</td>
<td>K-8</td>
<td>10</td>
<td>4.67</td>
<td>.40</td>
<td>.65</td>
</tr>
<tr>
<td>Pretest</td>
<td>9-post sec.</td>
<td>7</td>
<td>4.57</td>
<td>.41</td>
<td></td>
</tr>
<tr>
<td>Posttest</td>
<td>K-8</td>
<td>10</td>
<td>4.78</td>
<td>.35</td>
<td>.76</td>
</tr>
<tr>
<td>Posttest</td>
<td>9-post sec.</td>
<td>7</td>
<td>4.83</td>
<td>.24</td>
<td></td>
</tr>
<tr>
<td>Pretest</td>
<td>BS/BA</td>
<td>7</td>
<td>4.62</td>
<td>.42</td>
<td>.94</td>
</tr>
<tr>
<td>Pretest</td>
<td>MS+</td>
<td>10</td>
<td>4.63</td>
<td>.40</td>
<td></td>
</tr>
<tr>
<td>Posttest</td>
<td>BS/BA</td>
<td>8</td>
<td>4.83</td>
<td>.24</td>
<td>.76</td>
</tr>
<tr>
<td>Posttest</td>
<td>MS+</td>
<td>10</td>
<td>4.78</td>
<td>.35</td>
<td></td>
</tr>
</tbody>
</table>

p<.10.
t-test indicates no significant difference between demographic variables concerning the necessity of using computer-related technologies in education at .10.
<table>
<thead>
<tr>
<th>Items</th>
<th>Pretest</th>
<th>Posttest</th>
<th>Iowa</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 I think that computers make my professional work easier</td>
<td>4.59</td>
<td>4.35</td>
<td>3.96</td>
</tr>
<tr>
<td>2 I am comfortable in using computer-related technologies for my own work</td>
<td>4.06</td>
<td>4.18</td>
<td>3.51</td>
</tr>
<tr>
<td>3 I think computers make work more enjoyable</td>
<td>4.12</td>
<td>4.12</td>
<td>3.76</td>
</tr>
<tr>
<td>4 It has been easy for me to learn how to use a computer successfully</td>
<td>3.59</td>
<td>4.12</td>
<td>3.14</td>
</tr>
<tr>
<td>5 Teachers need to know how to use a computer</td>
<td>4.24</td>
<td>4.88</td>
<td>4.40</td>
</tr>
<tr>
<td>6 Computer-related technologies are an important part of the future for improving the quality of education</td>
<td>4.88</td>
<td>4.77</td>
<td>4.30</td>
</tr>
<tr>
<td>7 I have confidence in using a computer to complete my work</td>
<td>2.06</td>
<td>1.88</td>
<td>2.94</td>
</tr>
<tr>
<td>8 I would like to improve my skills in the use of computer-related technologies</td>
<td>4.77</td>
<td>4.53</td>
<td>4.29</td>
</tr>
<tr>
<td>9 I don't feel threatened by computers</td>
<td>4.12</td>
<td>4.29</td>
<td>3.74</td>
</tr>
<tr>
<td>10 The computer is useful for accessing and organizing information</td>
<td>4.82</td>
<td>4.77</td>
<td>4.25</td>
</tr>
<tr>
<td>11 Word processing makes writing easier</td>
<td>4.82</td>
<td>4.77</td>
<td>4.21</td>
</tr>
<tr>
<td>12 Computers are valuable tools that can be used to improve the quality of education</td>
<td>4.77</td>
<td>4.88</td>
<td>4.28</td>
</tr>
<tr>
<td>13 Computer-related technologies should be used to improve learning throughout the curriculum</td>
<td>4.65</td>
<td>4.71</td>
<td>4.14</td>
</tr>
<tr>
<td>14 Computers are useful for teaching thinking and problem solving skills</td>
<td>4.35</td>
<td>4.77</td>
<td>4.01</td>
</tr>
<tr>
<td>15 Computer-related technologies should be used by teachers more than they are now</td>
<td>4.65</td>
<td>4.77</td>
<td>4.09</td>
</tr>
<tr>
<td>16 My teaching is positively affected when using computer-related technologies</td>
<td>4.12</td>
<td>4.18</td>
<td>3.69</td>
</tr>
<tr>
<td>17 I feel comfortable using computer-related technologies in my teaching</td>
<td>4.12</td>
<td>4.24</td>
<td>3.49</td>
</tr>
</tbody>
</table>
Table 8 (cont.)

<table>
<thead>
<tr>
<th>Items</th>
<th>Pretest</th>
<th>Posttest</th>
<th>Iowa</th>
</tr>
</thead>
<tbody>
<tr>
<td>18 Computer-related technologies are necessary luxuries in most school settings</td>
<td>4.65</td>
<td>4.77</td>
<td>4.25</td>
</tr>
<tr>
<td>19 Computers are of value in education because they can be used to teach several subjects</td>
<td>4.71</td>
<td>4.94</td>
<td>4.32</td>
</tr>
<tr>
<td>20 The computer helps me obtain individual diagnostic information from student test scores</td>
<td>3.59</td>
<td>3.47</td>
<td>3.15</td>
</tr>
<tr>
<td>21 Overall, I think the computer is a very important tool for instruction in my classroom</td>
<td>4.65</td>
<td>4.29</td>
<td>3.93</td>
</tr>
<tr>
<td>22 Computer-related technologies are of value in the classroom because they are easy to use</td>
<td>4.53</td>
<td>4.71</td>
<td>4.19</td>
</tr>
<tr>
<td>23 I would like to use computer-related technologies more in my teaching</td>
<td>4.77</td>
<td>4.53</td>
<td>4.19</td>
</tr>
</tbody>
</table>

1 - Strongly Disagree  2 - Disagree  3 - Undecided  4 - Agree  5 - Strongly Agree

Questions 1, 4, 5, 7, 11, 17, 18, 19, and 22 were originally negatively stated. They have been reverse scored.

Participant Stages of Concern

Research Question 2: Will the levels of concern of the participants, as measured by the Stages of Concern About the Innovation Questionnaire, change and follow a progressive developmental pattern during the early stages of the innovation adoption process?

Findings: The stages of concern profile for the group changed significantly on the pre/posttest. While a significant total profile change did not occur between the post and secondary posttests, particular individual stage intensities did change significantly. The group exhibited a typical development pattern from that of a stage 0 nonuser to a stage 1 user.
The Stages of Concern About the Innovation Questionnaire was used to access the concerns of the participants in relation to hypermedia. The 35 questions were answered using a Likert scale ranging from 0 to 7. The scale for these items was as follows: 0 = Irrelevant to me; 1-2 = Not at all true of me at this time; 3-5 = Somewhat true of me now; and 6-7 = Very true of me now. Combinations of these questions produced percentile scores or levels of intensity for each of the seven stages of concern. The questions applicable to each stage are as follows:

Stage 0 - 3, 12, 21, 23, 30
Stage 1 - 6, 14, 15, 26, 35
Stage 2 - 7, 13, 17, 28, 33
Stage 3 - 4, 8, 16, 25, 34
Stage 4 - 1, 11, 19, 24, 32
Stage 5 - 5, 10, 18, 27, 29
Stage 6 - 2, 9, 20, 22, 31

The Stages of Concern About the Innovation Questionnaire (SoCQ) was scored using a computer spreadsheet to produce individual percentile scores for each stage of concern.

Graphs of individual profiles were produced to provide visual evidence of the concerns progression. The profiles were interpreted according to the guidelines proposed by Hall, George, and Rutherford (1986). The individual profiles and interpretations are represented in Appendix B. Group profiles were produced from the mean percentile scores of the individual profiles. The group mean percentiles are found in Table 9.
Table 9. Stages of Concern About the Innovation group percentile scores.

<table>
<thead>
<tr>
<th>Test</th>
<th>N</th>
<th>Stage</th>
<th>Mean</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td>16</td>
<td>0</td>
<td>72</td>
<td>29</td>
<td>98</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>85</td>
<td>34</td>
<td>99</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>65</td>
<td>5</td>
<td>97</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>65</td>
<td>11</td>
<td>90</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>39</td>
<td>3</td>
<td>82</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
<td>74</td>
<td>19</td>
<td>98</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6</td>
<td>30</td>
<td>1</td>
<td>69</td>
</tr>
</tbody>
</table>

Posttest 16 0 54 10 89
|           |   | 1     | 78   | 51      | 97      |
|           |   | 2     | 61   | 5       | 89      |
|           |   | 3     | 63   | 18      | 94      |
|           |   | 4     | 55   | 19      | 92      |
|           |   | 5     | 79   | 9       | 98      |
|           |   | 6     | 58   | 2       | 90      |

Sec. Posttest 16 0 60 10 91
|           |   | 1     | 74   | 43      | 96      |
|           |   | 2     | 54   | 25      | 95      |
|           |   | 3     | 63   | 18      | 98      |
|           |   | 4     | 43   | 16      | 71      |
|           |   | 5     | 77   | 31      | 98      |
|           |   | 6     | 46   | 2       | 87      |

One subject's answer sheet was incomplete and omitted from these data.

The group profile indicates several distinct change patterns. A significant change is indicated by a shift of ten points or more. Stage 0 concerns show a significant shift from a pretest score of 72 to a posttest score of 54. The change found in the stage 0 concerns for the posttest and secondary posttest were insignificant. The stage 1 and 2 concerns showed a gradual, but significant shift from the pretest to the secondary posttest (Stage 1 = 85 to 74, Stage 2 = 65 to 54). A significant change could be seen between the pre and posttest and between the posttest and secondary posttest at stage 4 and stage 6. Stage 3 and stage 5 showed no significant change during the assessment.
The group profile indicated high concerns at stages 0, 1, and 5 on the pretest. The posttest results showed high concerns at stages 1, 5, and 6. Secondary posttest results indicated high concerns at stages 1 and 5. The range of scores are indicative of a group that has a broad range of experience with the innovation. The group profile produced from these average percentile scores is found in Figure 4.

Figure 4. Stages of Concern About the Innovation group profile.

Participant Cognitive Knowledge

Research Question 3: Will the participant's knowledge level, as measured by the Hypermedia Knowledge Test, change during the initial stages of the innovation adoption process?
The Hypermedia Knowledge Test consists of 47 multiple choice questions. The test consisted of four types of questions. These types were as follows:

Type 1 - Definition of hypermedia
Type 2 - Research issues
Type 3 - Implementation
Type 4 - Design

The questions were randomly mixed throughout the test. The responses to the Hypermedia Knowledge Tests were computer scored.

Section 1: Analysis of Hypermedia Knowledge Test Results.

Findings: There was a significant difference between the pretest and posttest scores. No significant difference was found between the posttest and secondary posttest scores.

The scores of the pretest ranged from 21 to 36. The average score of the pretest was 28.41, SD = 3.59. On the initial posttest, the scores ranged from 26 to 38. The average score of the initial posttest was 32.59, SD = 3.50. The scores of the secondary posttest ranged from 25 to 39. The average score of the secondary posttest was 31.88, SD = 3.91.

A t-test was conducted to evaluate the change between the three tests. As shown by Table 10, there was a significant difference between the pretest and posttest results. It was found that no significant difference existed between the initial posttest and secondary posttest (Table 11).
Table 10. Descriptive statistics and t-test results for the pre and post Hypermedia Knowledge Tests.

<table>
<thead>
<tr>
<th>Test</th>
<th>N</th>
<th>Mean</th>
<th>S.D.</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td>17</td>
<td>28.41</td>
<td>3.59</td>
<td>.001**</td>
</tr>
<tr>
<td>Posttest</td>
<td>17</td>
<td>32.59</td>
<td>3.50</td>
<td></td>
</tr>
</tbody>
</table>

**p<.10.
t-test indicates there is a significant difference between pretest and posttest at .10.

Table 11. Descriptive statistics and t-test results for the post and secondary post Hypermedia Knowledge Tests.

<table>
<thead>
<tr>
<th>Test</th>
<th>N</th>
<th>Mean</th>
<th>S.D.</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posttest</td>
<td>17</td>
<td>32.59</td>
<td>3.50</td>
<td>.31</td>
</tr>
<tr>
<td>Sec. Posttest</td>
<td>17</td>
<td>31.88</td>
<td>3.91</td>
<td></td>
</tr>
</tbody>
</table>

p<.10.
t-test indicates there is a no significant difference between the posttest and secondary posttest at .10.

Section 2: Analysis of Demographic Variable Differences on the Hypermedia Knowledge Test.

Findings: There was a significant difference between the BS/BA level and MS/above level scores on the posttest. There were no significant differences found for the other demographic variables on each of the three tests.

Three demographic variables were analyzed for differences in Hypermedia Knowledge Test scores. These variables were the gender, level of education, and teaching level of the participant's. The SPSS t-test procedure was used to determine if any differences existed between the different levels of each demographic variable.
The sample consisted of three males and fourteen females. The average pretest score for males and females was found to be 29.67 and 28.14, respectively. Initial posttest averages for males and females were 32.83 and 32.64, respectively. Averages of the Secondary posttest for males and females were 30.67 and 32.14, respectively. As Table 12 indicates, no significant differences were found for each of the three tests.

Table 12. Descriptive statistics and t-test results for gender differences on the pre, post, and secondary post Hypermedia Knowledge Tests.

<table>
<thead>
<tr>
<th>Test</th>
<th>Gender</th>
<th>N</th>
<th>Mean</th>
<th>S.D.</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td>Male</td>
<td>3</td>
<td>29.67</td>
<td>2.52</td>
<td>.53</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>14</td>
<td>28.14</td>
<td>3.80</td>
<td></td>
</tr>
<tr>
<td>Posttest</td>
<td>Male</td>
<td>3</td>
<td>32.33</td>
<td>4.16</td>
<td>.86</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>14</td>
<td>32.64</td>
<td>3.52</td>
<td></td>
</tr>
<tr>
<td>Secondary Posttest</td>
<td>Male</td>
<td>3</td>
<td>30.67</td>
<td>4.51</td>
<td>.58</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>14</td>
<td>32.14</td>
<td>3.92</td>
<td></td>
</tr>
</tbody>
</table>

p<.10. t-test indicates there is a no significant difference between Male and Female subjects on the pre, post and secondary post Hypermedia Knowledge Tests at .10.

Teaching level of the participants was divided into two groups. Participants were placed in group one if they worked within the K-8 grade levels. Participants that worked at the high school or post secondary levels were placed in group two. Group one test scores had averages of 27.50, 32.30, and 31.60 for the pre, post and secondary posttests. The averages for group two were 29.71, 33.00, and 32.29 for each of the tests. No significant differences based on teaching level of the participants were found for any of the three tests (see Table 13).
Table 13. Descriptive statistics and t-test results for teaching level differences on the pre, post, and secondary post Hypermedia Knowledge Tests.

<table>
<thead>
<tr>
<th>Test</th>
<th>Teaching Level</th>
<th>N</th>
<th>Mean</th>
<th>S.D.</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td>K-8</td>
<td>10</td>
<td>27.50</td>
<td>3.72</td>
<td>.22</td>
</tr>
<tr>
<td></td>
<td>9-post secondary</td>
<td>7</td>
<td>29.71</td>
<td>3.20</td>
<td></td>
</tr>
<tr>
<td>Posttest</td>
<td>K-8</td>
<td>10</td>
<td>32.30</td>
<td>3.65</td>
<td>.70</td>
</tr>
<tr>
<td></td>
<td>9-post secondary</td>
<td>7</td>
<td>33.00</td>
<td>3.51</td>
<td></td>
</tr>
<tr>
<td>Secondary</td>
<td>K-8</td>
<td>10</td>
<td>31.60</td>
<td>2.88</td>
<td>.73</td>
</tr>
<tr>
<td>Posttest</td>
<td>9-post secondary</td>
<td>7</td>
<td>32.39</td>
<td>5.31</td>
<td></td>
</tr>
</tbody>
</table>

\( p < .10 \).

T-test indicates there is no significant difference between K-8 and 9-post secondary subjects on the pre, post and secondary post Hypermedia Knowledge Tests at .10.

Level of education of the participant's refers to the status of their post secondary education. The participants were divided into two groups in order to analyze any differences in test scores due to the level of education. The two groups consist of all participants that hold a bachelors degree. Members of group one may also hold a bachelors degree and additional graduate credits, but have not yet received a Masters degree. Group two consists of all participants that hold at least a Masters degree. The average scores for group one and two for the pretest were 28.50 and 28.33. Groups one and two had initial posttest average scores of 30.38 and 34.56. The average scores of the secondary posttest for group one and two were 30.63 and 33.00. As Table 14 indicates, there was a significant difference in the average scores of group one and two on the initial posttest. No significant difference was found on the pretest and secondary posttests.
Table 14. Descriptive statistics and t-test results for level of education differences on the pre, post, and secondary post Hypermedia Knowledge Tests.

<table>
<thead>
<tr>
<th>Test</th>
<th>Level of Education</th>
<th>N</th>
<th>Mean</th>
<th>S.D.</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td>BS/BA</td>
<td>7</td>
<td>28.50</td>
<td>2.98</td>
<td>.89</td>
</tr>
<tr>
<td></td>
<td>MS/MA+</td>
<td>10</td>
<td>28.33</td>
<td>4.24</td>
<td></td>
</tr>
<tr>
<td>Posttest</td>
<td>BS/BA</td>
<td>7</td>
<td>30.38</td>
<td>2.62</td>
<td>.009*</td>
</tr>
<tr>
<td></td>
<td>MS/MA+</td>
<td>10</td>
<td>34.56</td>
<td>3.05</td>
<td></td>
</tr>
<tr>
<td>Secondary</td>
<td>BS/BA</td>
<td>7</td>
<td>30.63</td>
<td>4.72</td>
<td>.22</td>
</tr>
<tr>
<td>Posttest</td>
<td>MS/MA+</td>
<td>10</td>
<td>33.00</td>
<td>2.87</td>
<td></td>
</tr>
</tbody>
</table>

*p<.10.
t-test indicates there is a significant difference between BS/BA and MS/MA+ subjects on the post Hypermedia Knowledge Test at .10.

Secondary Findings

Demographic Information

Demographic information was gathered from the study participants. Of the seventeen participants, fourteen were female and three were male. The average participant is characterized as follows:

Level of Education: Master's degree

Age: 41.53 years

Years of Teaching Experience: 11.76 years

All seventeen of the participants had used a computer at home or at work prior to the workshop. Of the seventeen respondents, fifteen had used the computer for teaching purposes for an average of five years. The grade level taught by the
participants were as follows:

- Grade 5: 2
- K-5 combined: 2
- 7-8: 5
- K-8 combined: 1
- High School: 3
- K-12 combined: 1
- College: 2
- No Response: 1

The size of the school district of each participant varied widely. The participants reported the following:

- \( \leq 500 \): 3
- 501-1500: 4
- 1501-3000: 1
- 3001-5000: 5
- >5000: 2
- Not applicable: 2

The level of available hypermedia-related technology in the above school districts also varied. Twelve participants reported very little to moderate levels of equipment available. Only three participants reported an adequate level of equipment was available for hypermedia applications.

Twelve of the participants rated their pre-workshop hypermedia knowledge level as very little or none. Only two participants rated their knowledge level as above average. In the final set of instruments, ten of the seventeen participants responded that they were currently using hypermedia in
some form. The seven respondents who were not using hypermedia rated four reasons (a scale of 1-low to 4-high) for their lack of use. These are found in Table 15. All of the participants rated the importance of hypermedia to education as average or above. Seven gave a response of above average and four a response of high. All but one participant reported that hypermedia work with peers was planned or underway.

Support Received By Participants

The participants were queried about the types of support mechanisms that were available and being used. A variety of support mechanisms were in place at the time of the workshop. The Electronic Education Exchange (EEE), an electronic bulletin board located at Iowa State University's College of Education, had a specific section devoted to hypermedia users. Access to the bulletin board was via a toll free number. One participant reported using the EEE bulletin board during the three months after the workshop. Area Education Agencies (AEA)

<table>
<thead>
<tr>
<th>Reason</th>
<th>low</th>
<th>average</th>
<th>above average</th>
<th>high</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of interest (3)</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Lack of time (4)</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Lack of equipment (6)</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Feel uncomfortable using hypermedia (5)</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>
make available technical support through phone and personal contacts. Only two participants made use of AEA support. Another form of support is through the computer dealer outlets. One participant reported receiving help from a dealership.

The participants were asked to rate the level of support received from within their school district. The scale ranged from none (1) to excellent (5). The participants ratings are found in Table 15. The participants rated the students as

Table 15. Support concerning the use and diffusion of hypermedia received from specific groups/individuals as rated by the participants.

<table>
<thead>
<tr>
<th>Group/Individual</th>
<th>None</th>
<th>Poor</th>
<th>Good</th>
<th>Very Good</th>
<th>Excellent</th>
<th>No Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>AEA</td>
<td>5</td>
<td>3</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Community</td>
<td>7</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>School Board</td>
<td>6</td>
<td>5</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Superintendent</td>
<td>7</td>
<td>4</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Principal</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Other Teachers</td>
<td>4</td>
<td>6</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Students</td>
<td>5</td>
<td>1</td>
<td>6</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

providing the highest level of support for hypermedia use and diffusion. The average student rating of 2.43 was nearly midway between poor and good. AEAs, principals and other teachers all received average ratings of at least 2. Principals had a average rating of 2.2; other teachers had a average rating of 2.13; and AEAs had a rating of 2.29. The lowest average rating belonged to superintendents at 1.71. A total support rating was calculated by averaging all of the responses. The total support rating was 2.07 which was slightly above poor.
CHAPTER V. DISCUSSION OF RESULTS

The major results of this study are discussed in this chapter. The results of the attitudinal and concerns sections are compared to previous research studies. Implications of the study and recommendations for future research will be followed by a chapter summary.

Review

The goal of this study was to better understand the changes educators undergo during the adoption of a computer-related innovation. The study examined the change patterns of three particular areas of interest: 1) attitudes concerning technology and its use in education, 2) concerns about the innovation, and 3) cognitive knowledge in relation to the innovation. Three demographic variables were examined in relation to the attitudes and cognitive knowledge of the participants: 1) gender, 2) teaching level (K-8 or 9-post secondary), and 3) level of education (BS/BA or MS/MA and above).

The instruments used for analysis of these variables included: 1) an attitude scale, 2) a concerns scale, and 3) a cognitive knowledge test. The instruments were administered as pre, post, and secondary post evaluations. The data were collected from seventeen teachers who participated in a summer workshop concerning hypermedia.

Three research questions were addressed by this study. (1) Will the participant's attitudes concerning the use of technology in education, as measured by the attitudinal section of the The Iowa Survey of Computer Related Technology Use by K-12 Teachers, change during the initial stages of the
innovation adoption process?, (2) Will the levels of concern of the participants, as measured by the Stages of Concern About the Innovation Questionnaire, change and follow a progressive developmental pattern during the early stages of the innovation adoption process? and (4) Will the participant's knowledge level, as measured by the Hypermedia Knowledge Test, change during the initial stages of the innovation adoption process?

Interpretation of Research Question One

Descriptive Statistics of Attitudes Concerning Technology Usage in Education

Improvement in attitude and confidence has been found to be related to the reduction of the level of anxiety and can best be accomplished through participation in computer inservice (Gressard and Loyd, 1985; Madsen and Sebastiani, 1987). In order to determine the effectiveness of the workshop environment in changing attitudes of participants, the attitudinal section of The Iowa Survey of Computer Related Technology Use by K-12 Teachers (ISCRT) was administered prior to and three months after a summer hypermedia workshop. The survey was not administered immediately after the workshop in order to minimize the novelty effects of the workshop itself.

A survey of 1829 Iowa K-12 teachers conducted by the Iowa Department of Education and Iowa State University (1991) revealed three distinct attitudinal factors. These factors were: 1) general attitudes toward computer-related technology, 2) confidence toward using computer-related technologies, and 3) attitudes about the necessity of using computer-related technologies in education. The three factors were used in this study for the purpose of comparing data to the state average (baseline).
The state average for the general attitudes of teachers toward computers and computer-related technologies factor was slightly higher than agree (4.05). In this study, the average of the participants was higher both on the pre (4.57) and posttest results (4.55). The questions related to this factor on the state survey and this study exhibit marked differences. One of the most positive responses found on the state survey was "Computer-related technologies are an important part of the future for improving the quality of education" ($\bar{x}=4.30$). The same question had an average response of 4.88 (pretest) and 4.77 (posttest) in this study. The question with the lowest average score, "My teaching is positively affected when using computer-related technologies," had an average score of 4.12 (pretest) and 4.17 (posttest) on this survey. The state results indicate an average of 3.70 for the same question. This would indicate that the participant's general attitudes about computer-related technologies were higher than the State of Iowa average prior to and after the workshop.

In the current study, the average for the second factor, "confidence towards using computer-related technologies," was 3.85 (pretest) and 3.92 (posttest). This was higher than that of the state survey (3.60). The level of confidence exhibited by the participants indicates they were somewhat more confident in their abilities to use computer-related technologies. The results of the state survey and of this study would tend to indicate that both groups have a moderate degree of confidence towards using computer-related technologies in education. The question, "I think that computers make my professional work more difficult," received the highest average response on both the state survey and in this study. This question was reverse scored making it reflect improvement of (...make my professional work easier) rather than degradation of the participant's work
efforts. The participants of this study indicated a higher degree of agreement (4.59 pretest/4.35 posttest) with this statement as compared to the state survey (4.00).

The third factor, "attitude toward the necessity of computer-related technologies in education," also indicated differences between the state results and those of this study. The state average for this factor was 4.24. The responses to this study show a average of 4.63 for the pretest and 4.84 for the posttest. This indicates a high level of agreement by the participants about the necessity of using computer-related technologies in education. The participants showed a significant positive increase in their attitudes concerning this factor during the three month study. The subject matter, hands-on experiences, and post workshop experiences could have combined to produce this change in attitude.

An important factor that may have contributed to the differences found between this study and the State of Iowa survey is computer experience. All of the participants of this study have used computer-related technologies in education as compared to 77.2% of the state study group. Without practical experience, the 22% of the state study that did not use computers in the classroom may not be able to positively contribute to the average score of this factor.

Summary

The attitudes of the participants of this study were found to be higher than the average for the State of Iowa (1991) both prior to and after the workshop. This difference could be explained by the interest in technology expressed prior to the workshop by the participants through their enrollment in the workshop and
by their level of computer experience. The workshop was able to maintain the high levels for all three factors. In addition, participant attitudes concerning the necessity of using computers in education were significantly higher after the workshop.

Trotter (1989) stated that hypermedia allows the teacher the freedom to put control of learning in the student's hands and giving the learner a variety of media from which to approach the learning process. This is different than previous forms of computer instruction. The diversity and adaptability of hypermedia applications for use in education may have helped produce the positive increase in the participants' attitudes.

Factor one and three results were scaled positively to such a degree on the pretest that any change would only indicate a reinforcement of already existing attitudes. The strength of the results of factor two would seem to indicate that the participants believed that computer-related technologies can and do make professional work easier, but have some reservations about their own ability to operate and work with the technologies.

Interpretation of Research Question Two

Profile Interpretation of Participant's Concerns About Hypermedia - Group

Stages of Concern

According to Hall, et al (1986), concerns about innovations seem to be developmental. The early concerns must be resolved prior to the emergence of later concerns. As the subject makes gains in knowledge and experience, the stages can shift from lower, more personal concerns to higher student/peer related levels. The stages an individual pass through are similar to the process of
adoption and diffusion described by Rogers (1986). While knowledge about or experience with an innovation are not the only contributors to the progression of concerns, they are considered to be of major importance in this progression (Hall 1986).

The group results for the pre and primary post evaluations are shown in Figure 5. The results show that as a group, the subjects showed a shift from high concerns at stage 0 and stage 5 to high concerns at stage 1 and 5. This progression from stage 0 to stage 1 demonstrates the expected change as the subjects are exposed to and gain experience with an innovation. According to Hall, et al (1986) a shift of ten or more points is considered significant. The stage 0 concerns have dropped significantly on the posttest profile. This is indicative of the

![Figure 5. Group Stages of Concern About the Innovation for the pre and primary post evaluations.](image-url)
heightened awareness and increased concern about the innovation. The high stage 1 concerns indicate that the group is in search of more information about the innovation. The high stage 1 and 5 combination is typical of a user who is interested in learning about what others know and are doing.

The stage 5 concerns could be caused by different factors. The initial high stage 5 found in the pretest could be due to the environment of the workshop. Few of the participants were acquainted with each other prior to the workshop. The concern could be related to the collaborative efforts that were to be required of the subjects in the workshop environment. The later collaborative concerns could be generated by the instructor's suggestion concerning the participant's involvement with the diffusion of the innovation into their work places. The collaborative concerns could be demonstrating a shift from an internal workshop concern to an external or home-site diffusion concern. The large increase in the level of concern at stage 4 shows that the subjects are more concerned about the innovation as it pertains to its use in the classroom. The unknown effect of the innovation on students could be seen as potentially threatening by the subjects which would increase the concern level at stage 4. The increased concerns at stages 4 and 5 contribute to the heightened concerns at stage 6. The subjects are considering other options for the modification or replacement of the innovation in the educational environment. A comparison to software packages that the subjects have previous experience with would contribute to the increased stage 6 concerns. The subjects have moved from a stage 0 non-user status to that of a stage 1 user that is very much involved with the innovation.
Comparison of the Primary Post and Secondary Post SoC

The group profile makes two significant changes on the secondary post profile. These changes are shown in Figure 6. Stage 0 and 1 intensities remain nearly identical indicating the subjects are still very much involved with and in search of more information about the innovation. Stage 2 concerns have dropped although not significantly. This indicates that the group is not as threatened by the demands of the innovation on their personal time. This is indicative of individuals that are genuinely interested in the innovation and are open to new ideas (Hall, 1986). Of interesting note, the stage 3 concerns remained nearly constant throughout the study period. The lack of time and equipment

Figure 6. Group Stages of Concern About the Innovation for the post and secondary post evaluations.
required to effectively use hypermedia, as indicated by the subjects, could contribute to this. Stage 4 concerns have dropped significantly on the secondary post profile. The same characteristics that contribute to the constancy of the stage 3 concerns may also contribute to the drop in stage 4. If the use of hypermedia is perceived as impractical or impossible due to logistics, concerns about the effects of the innovation on students potentially could decrease. Stage 5 concerns remain constant as the participants still are viewed as resident experts in the field and are concerned with the diffusion aspect of the innovation. A lack of knowledge about any aspect of the innovation could intensify the stage 5 concern due to its contribution to feelings of inadequate background knowledge by a potential diffuser. The stage 6 concerns also have dropped significantly. This could be indicative of individuals that have been comparing and contrasting other software packages with the current innovation. The stage 6 intensity level could drop due to elimination of other potentially conflicting software packages. The group is in the process of finding more information about the innovation and has not made the progression to that of a stage 2 or 3 user.

Summary

As expected, the pre-workshop concerns of the subjects were initially high at stage 0 indicative of a lack of knowledge and/or concern about the innovation. In addition, the typical subject had intense concerns at stage 5. The high stage 0 concerns are typical of a nonuser or beginning user.

During the course of the workshop, the subjects were highly immersed in the study of and experimentation with the innovation. While the duration of the workshop and the time period between administration of the pre and post
SoC was relatively short, a noticeable shift in concerns is discernible. The stage 0 concerns drop significantly while personal and student related concerns increase. This progressive change indicates that the typical user has progressed to the stage 1 level. The stage 5 concerns maintained a high level of intensity. The stage 6 concerns have increased significantly indicating that the subjects are comparing the innovation with other potential alternatives.

The secondary posttest profile exhibits only minor changes from the initial posttest profile. Stage 4 and 6 concerns have dropped significantly. The subjects have not progressed past that of the stage 1 user. The maintenance of concern levels at stages 0, 1, 2, 3, and 5 along with the drops in stages 4 and 6 might indicate that the subjects were not intensely involved with the innovation during the post workshop time period.

The strength of the concerns at stage 5 could have resulted from a variety of factors. The lack of knowledge about the innovation as shown in the SoC results and the HKT results could be a primary contributor to this concern intensity. In addition, the expectations placed on the subjects concerning working with peers at their school district could be also be a major contributor to the high stage 5 concerns.

Teachers concerns provide the basis for decisions made during both the adoption and the implementation phases of staff development. Staff developers must address the concerns of the participants during the staff development process (Lawrence, 1974; Guskey, 1986). By analyzing these concerns, staff development programs can be effectively designed and implemented to provide instruction in areas that will have the greatest impact and provide for positive change in education.
Interpretation of Research Question Three

Descriptive Statistics of Participants' Knowledge of Hypermedia

A test instrument had to be designed to assess the degree of knowledge retention of the participants. Questions in the test instrument addressed four areas similar to those outlined by Marchionini (1988). These were (1) Definition of hypermedia, (2) Research issues related to hypermedia, (3) Implementation of hypermedia, and (4) Design of hypermedia environments. The development of the hypermedia test is outlined in Appendix A.

The test was administered prior to, immediately following, and three months after the workshop. A t-test was used to analyze any differences in the results. The scores of the posttests were found to be significantly higher from those of the pretests. No differences were found between the scores of the posttest and the secondary posttest.

The scores of the pretest ranged from 21 to 36 with an average of 28.41. Factors affecting the participant's scores might include the test format and the degree of previous exposure to hypermedia. The multiple choice format of the test might have allowed for some participants to randomly guess correct answers or use the process of elimination to select an answer. The participants level of experience concerning hypermedia prior to the workshop was very low. Twelve of the participants reported little or no previous experience. Of the remaining five, only two rated their knowledge level as above average. This wide range of exposure to hypermedia could be a contributor to the wide range of pretest scores.

The posttest scores ranged from 26 to 38 with an average of 32.59. The posttest average was slightly more than four points higher than the pretest
average. This indicates a significant positive change in the scores of the participants. Fifteen of the seventeen participants showed an increase from their pretest scores indicating that the workshop was successful in increasing the knowledge level of the participants in relation to hypermedia.

Several factors could have contributed to the change found between the pretest and posttest scores. Previous research indicates that an effective inservice should be designed to provide impact in a graduated sequence by providing initial awareness of the topic, an understanding of the inherent concepts and their relationships to the learning process, skill acquisition, and application/problem solving (Dedrick, Decker and Hansen, 1989). The workshop was designed to give the participants a gradual exposure to hypermedia through an introduction to research issues, instruction in the use of hypermedia, and hands-on experience. The hands-on experience increased during the later stages of the workshop until it accounted for nearly 75% of the contact time. Participants had access to the equipment an additional nine hours outside of the workshop. While the exact amount of time each participant used available technology could not be assessed, direct observation by workshop instructors indicated that participant's usage of the equipment during non-class hours was significant.

The final stages of the workshop consisted of cooperative group design of a hypermedia project. This format is conducive to increased learning in a workshop or staff inservice program. Research has indicated that teacher attitudes toward computers and computerized instruction are critical to the successful implementation of a computer-based education program. The
positive attitudes of the participants concerning hypermedia and its use in education could have contributed to the increased learning.

While the secondary posttest scores did not differ significantly from the posttest scores, the range exhibited on the secondary posttest was wider by three points. This could be attributed to the degree of post workshop usage by the participants. Several of the scores of non-using individuals dropped, while several scores of active users increased.

The lack of change of the secondary posttest scores could be affected by the participants lack of use of support mechanisms. Research indicates that a diverse support structure following inservice is necessary to significantly improve the level of sustained implementation of a program (Winkler and Stasz, 1985; Guskey, 1986; Rappa et al., 1983; Borg, 1972). While several support structures were made available, only four participants reported using any type of support structure.

Summary

Research has indicated that three major problems - literacy, the learning environment, and the teaching environment - are associated with hypermedia. In order for teachers to become users of hypermedia, four primary areas of concern must be addressed. The teacher must understand the underlying principles concerning hypermedia while managing, creating and evaluating these unique environments. The workshop attempted to deliver instruction that dealt with these areas. Successful staff development programs place the teacher in an active role, provide individualized training experiences, multiple demonstrations, supervised trials, and feedback, encourage sharing and
providing of mutual assistance. The workshop provided the participants with an environment that met all of the above criteria. Emphasis was placed on cooperative hands-on experiences that resulted in the development of a teacher usable product.

The participants' knowledge about hypermedia prior to the workshop was low, as determined by the Hypermedia Knowledge Test (HKT). The average pre-workshop score was 28.41 (47 possible). The workshop was effective in raising the participants' HKT scores on the primary posttest to an average of 32.59. Retention of this knowledge was demonstrated by the lack of change exhibited by the secondary posttest scores in comparison to the primary posttest scores (average score = 31.88).

A variety of factors could have affected the test scores. The structure of the workshop was conducive to a positive performance by the participants. The stress placed on hands-on experiences and group cooperative learning appeared to be effective. Varying levels of pre-workshop knowledge and the degree of post workshop usage contributed to the wide range of scores found on the three tests.

Analysis of the Demographic Variables

This study analyzed three demographic variables: gender, teaching level, and degree held. The variables were each divided into two levels as follows:

Gender - Male/Female
Education Level - Bachelors/Masters and above
Teaching Level - K-8/9-post secondary
Interpretation of Attitudinal Differences for Demographic Variables

The attitudinal survey was administered to the participants prior to the workshop and three months after its conclusion. It was found that there were no significant differences in the general attitudes about and the confidence towards using computer-related technology factors. There was a significant change in the attitudes about the necessity of using computer-related technologies in education. This study wished to find out if there were any differences in attitude associated with the different levels of each demographic variable. A t-test was used to make this determination.

No significant differences were found between the K-8 and 9-post secondary levels for any of the attitudinal factors on either the pretest or posttest. This would indicate that the participants attitudes about computer-related technologies are not significantly different based on the grade level that they teach. The participants teaching levels ranged from grade 5 to college or university. Ten of the participants were K-8 instructors, while 7 were 9-post secondary instructors. Similarly, no significant differences were found between the participants that held Bachelors degrees or Masters/PhD degrees on either the pretest or the posttest. Nine of the seventeen participants held a Masters degree or higher. The differences found based on gender for the general attitudes about computer-related technologies factor were attributed to the limited sample size and disproportionate male/female ratio. for the general attitudes about computer-related technologies factor.

The attitudes of the participants were similar regardless of the demographic differences. This may be due in part to the fact that all seventeen of the participants had prior experience using computers. In addition, fifteen of the
100

participants had used the computer for teaching purposes. The high attitudes of the participants prior to and after the workshop make it difficult to accurately access any potential differences that might exist based on these demographic variables. It is obvious that, in general, all of the participants have extremely high attitudes about computer-related technologies. Therefore, any differences that might exist will be nearly impossible to detect. The differences found for the gender variable on the general attitudes factor could be due to the low number of males in relation to females and should be judged carefully.

Interpretation of Cognitive Knowledge Differences for Demographic Variables

Results of the t-tests of the three demographic variables and the HKT indicated that there was a significant difference between participants that hold a higher degree (Masters or above) and those holding a Bachelors only on the posttest. There were no differences found for level of education on the pre or secondary posttests. There were no significant differences found for teaching level or gender.

One possible reason for the difference between the participants' level of education and their test performance could be the advanced study skills developed by participants that hold advanced (Masters and above) degrees. The participants holding advanced degrees have been exposed to more class work, study time, and preparation time than those holding only a Bachelors degree. It is possible that the advanced degree holders have developed advanced, specific skills for observation, encoding material, and regurgitation of material during graduate studies. The lesser experienced participants that hold only the
Bachelors degree may not be properly prepared for the demands and level of study required by a graduate level course.

Interpretation of the Type and Degree of Support Used by Participants

Several support mechanisms were available to the participants after completion of the workshop. These support mechanisms included: (1) access to an electronic bulletin board via a toll free number, (2) Area Education Association technical support, (3) contact with the workshop instructors, (4) support from area computer dealerships, and (5) peer support within their school district.

The Electronic Education Exchange (EEE) bulletin board was a source of support with a nationwide base of users. Each participant received instruction for the access of this mechanism. Even though this service was offered at no cost to the user, only one participant made use of the EEE. One potential setback to the use of this service was the lack of access to communication equipment. While the participants were not directly queried about equipment access, three reported this problem during phone contact with workshop instructors. Overall, one participant called workshop instructors for support. All other contact was made during routine calls made by instructors for collection of data related to this study.

Support received various agencies concerning the use and diffusion of hypermedia were rated by the participants. Students were found to be the highest rated supporters of hypermedia usage. Eight of fourteen responses indicated good or better support from students. Five indicated that no support was received. While all of the participants rated the importance of using
hypermedia in education as average or above (average = 3 on a 5 point scale) only ten of the participants were actively using hypermedia in education. The lack of use of hypermedia in the classroom would effectively alter the degree of support received from students. With the exception of students, all other local support mechanisms were rated as poor or non-existent. The lowest rating was placed on the superintendents. Previous research indicates that administrative support is a necessary component of staff development if continued usage is to be accomplished (Rappa et al., 1983; Vitchoff, 1988). The low ratings placed on the administration might be an indicator of poor future usage and integration of hypermedia by the participants. In addition, the low ratings might be indicative of the administration's lack of awareness concerning hypermedia and maybe computer-related technologies in general.

The primary reasons for not using hypermedia in the classroom were lack of equipment (6 responses) and feeling uncomfortable using hypermedia (5 responses). Another response that received high marks was a lack of time. Lack of equipment is a logistics problem faced by many schools in Iowa (ISCRT, 1991). While there may be many reasons for this lack of equipment, it is a barrier that cannot be overcome without school assistance and planning. The lack of equipment (and the resulting implication of non-integration) does not mean that staff development and the attendance of workshops by the teachers is ineffective. Rather, it may be even more important for the teachers to receive training in the use of computer-related technologies. The additional knowledge and understanding of potential applications of computer-related technologies can help lead to making the purchase of computer equipment a district priority.
Recommendations for Further Study

These findings indicate that more research is necessary in the area of hypermedia usage in education.

The first recommendation is to extend the time period of the study. This study and others have found that using a carefully designed, participant-oriented workshop format is effective. A longer study period would allow the researcher to assess the long term cognitive and affective effects of the initial workshop and follow-up support mechanisms.

The second recommendation is to change the site of the staff development program to include the local school environment. Previous research has indicated that administrative support and involvement is a positive factor in successful staff development. Local on-site staff development to include administration, teachers, and support personnel would provide information concerning the effect of administrative involvement in the integration of computer-related technologies.

The third recommendation is to make support mechanisms more available and usable by workshop participants. This study indicated almost a complete lack of participant usage of support mechanisms. Through commitment from local school districts to supply teachers with the necessary equipment to access support devices, information pertaining to the effectiveness of these devices and their affect on innovation implementation could be obtained.

The fourth recommendation would be to ascertain the effectiveness of workshop participants in the classroom. This study indicated that the greatest
support for hypermedia usage was received from the students. Guskey (1986) stated that evidence of improvement in the students' learning outcomes produced a positive change in teacher attitudes and beliefs about the implemented program. A study which tested student knowledge and surveyed student attitudes concerning the innovation and teacher effectiveness would provide additional information concerning the goals of educational staff development.

The fifth recommendation is to restructure the study to access the participants' concerns prior to the workshop in order to address their concerns during the workshop itself. The concerns-based approach emphasizes understanding teacher attitudes and skills so that support activities can be directly related to what teachers perceive they need (Hall and Hord, 1987). By providing staff developers with information pertaining to the participants' concerns, the workshop could be structured to address these concerns at a level applicable to the participants. This would aid further study of the effectiveness of the staff development program.

The sixth recommendation is to extend the scope of the study to include previous and future workshop participants. By gathering data through the use of identical collection instruments, comparisons could be made of the similar and varying characteristics of different groups of workshop participants. This would provide more valuable information about the effectiveness of the workshop, its support mechanisms, and the degree of diffusion of the innovation.
Conclusions

The purpose of this study was to assess the effects of a short term, high intensity workshop on cognitive knowledge retention and the evolution of the subjects' level of concern about the innovation. Secondary in purpose was the evaluation of the participants' attitudes concerning technology prior to and after the inservice procedure.

The participants of this workshop characteristically were 41 years old, held a Masters degree, and had taught for approximately 12 years. Prior to the workshop, the participants' knowledge about hypermedia, according to the hypermedia test instrument, was limited. The concerns of the participants indicated that many were non users or beginning users. This was collaborated by the demographic survey. Additionally, their attitudes concerning computer-related technologies were very positive.

Through the use of three test instruments, the workshop was determined to be effective in producing a significant increase in the knowledge test scores and advancing the participants' innovation concerns to a higher level that is more conducive to the adoption and integration of hypermedia into the classroom. The participants entered the workshop with exceptionally positive attitudes about computer-related technologies. The workshop effectively raised their attitudes concerning the necessity of using these technologies in the classroom. The lack of interaction with the innovation and lack of use of the available support mechanisms after the conclusion of the workshop contributed to the lack of change of the knowledge test scores and further progression of the subjects' concerns.
The workshop design fit many of the recommendations outlined in previous research. This included placing an emphasis on participant input, hands-on experience, and cooperative learning. The participants were able to experience the concept of "ownership" through the production of a hypermedia application. These characteristics have been shown to be positively related to the success of staff development projects.

Of particular interest is the limited usage of support materials after the workshop. Only two of the participants used any form of support during the three month post-workshop period. This could imply that the means of support were ineffective or non-desirable for the participants.
REFERENCES


Hall, G. E., Wallace, R. C., Jr., and Dossett, W. A. (1973). A developmental conceptualization of the adoption process within educational institutions. Austin: The University of Texas, Research and Development Center for Teacher Education, Austin, TX.


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I would like to thank all of the people that have helped me during the process of completing my research and thesis. While there were times that frustration had set in, the encouragement and support never stopped. All of your help, love, and caring has made each of you a part of this project.

I would like to thank Dr. Ann Thompson for her role in the formation of this study. Her guidance, encouragement, and expertise provided me with the idea to begin. As long as people like her exist, the future of education will ever be advancing and reaching out to its true potential. Her insight has helped to show me what is possible.

Many thanks are due to my major professor, Dr. Roger Volker, who helped make this thesis what it is today. His stick-to-itiveness and unique observations have helped me to look at things and see them in a different light than I might have otherwise. He took on the difficult job of entering a research project when it was half finished and became an integral part of its completion.

I am forever grateful to my friend, Dr. Tom Walsh, for always being there to listen, give advice, and listen some more. Because of your support and knowledge the hill wasn't quite as steep. To his future wife, Allison, I thank you for your ever present words of encouragement.

I would like to thank my committee members, Dr. Michael Simonson and Dr. J. Peter Boysen, for their contributions to this project. Their questions and comments always made me look one step further and enhanced the quality of this study.
I would like to express my condolences and thanks to my ex-office mate, Karen, for listening to me moan and groan during the difficult times. An open ear is an invaluable assett in graduate school.

One of the greatest things a graduate student can have is a good model. Denise set an example of what hard work and diligence will do for you. Amazingly, she was always able to bring forth a smile through it all.

I would like to thank my family for their endless encouragement and support. Their love prevailed throughout this project. I could always count on the right words at the right time from each of them. At times support can come in small packages. A nudge of Kelly's wet nose and a lick of her tongue were all I needed to bring me back to my senses. Whenever I needed inspiration, all I had to do was look to her.

Finally, I would like to thank God for providing me with the strength, courage, and mind to come through this a better person.
APPENDIX A

DEVELOPMENT OF THE HYPERMEDIA KNOWLEDGE TEST
Test Topic Compilation
Brainstorming session for topic ideas
May 22, 1991

Defining Hypermedia
What is considered hypermedia?
Is there a difference between hypermedia, multimedia, and interactive multimedia?
The terminology

The Environment
What is a hypermedia environment?
Creating hypermedia that is educationally "sound"
Exploration of educational issues that affect the use of hypermedia in schools

The Classroom
Defining the role(s) of hypermedia in the classroom
How to integrate hypermedia into the classroom
Defining the usage of hypermedia systems in our schools

Design
hypermedia designed around the issues of concept, environment, and system
Understanding Non-linear design
Screen design and layout (ratio of text to graphics)
- understanding the difference between graphic and manipulatable text
- consistency in production

Use of graphics
Creating animation

Building Stacks
Scripting
The creation of the four basic components of a card
- buttons
- fields
- text
- graphics
  - foreground
  - background

Understanding the concept of foregrounds and backgrounds
Importing media
- from what sources
- using what techniques
Debugging the final product
- using HyperCard 2.0 debugging devices
Interfacing with external media sources
- CD-ROM
- Laserdisk
- Xapshot
- Scanners
- Video cameras

Setup of the appropriate equipment
Call for Participation in Test Construction

May 29, 1991

Dear Colleague,

I am working on the construction of a hypermedia knowledge test. The test will be used as a part of my thesis work concerning hypermedia and staff development. I am focusing my study around the summer hypermedia workshop offered at Iowa State University in June 1991. The participants will be administered the test before the workshop, after the workshop, and 1 month into the 1991-92 school year. It will be used to measure the change in conceptual and application knowledge of the participants.

You will find a list of four content areas for a hypermedia knowledge test on page two of this packet. Following this are individual sections containing objectives for that topic. You will note that two sections are listed at the bottom of this page. These are the sections on which I would like you to focus. Please read these objectives carefully.

This part of the construction phase of the test consists of designing questions that test the student's ability to comprehend and apply hypermedia skills as outlined by the objectives. The questions should be of multiple-choice design. Please write a series of questions (3-4) for each topic area addressing particular objectives found there.

For example:

Section Four-Objective 3/4
Which of the following scripts could be used to go to the next card?
A) On Mouseup
   next card
   End MouseUp
B) On OpenCard
   go to next card
   End OpenCard
C) On OpenStack
   go next card
   End OpenStack
D) B and C
E) All the above
Please write the section name on the same page as the questions you write for that section. If you would like to provide questions for any other sections, please feel free to do so.

These questions will be compiled to form the first version of the test. As time is growing short, I must ask that the questions be returned to me no later than Wednesday, June 5. This means that the questions should be in the mail by Tuesday, June 3 in order to arrive here on time.

I appreciate you help in this project. As soon as the test is checked for reliability and validity, I will send a copy to you for your use. Please call if you have any questions.

Thank You,

Dennis McElroy
N031 Lagomarcino
Iowa State University
Ames, IA 50011
(515) 294-6840 (work)
(515) 233-3530 (home)

Sections X and Y
Hypermedia Knowledge Test Section Definitions

Section One - Definition
A definition of what "hypermedia" is, the characteristics of hypermedia, and the differences and similarities between hypermedia and corresponding terminology (such as multimedia).

Section Two - Research Issues
The current research issues related to the use of hypermedia in education drawn from the prescribed articles in the workshop manual.

Section Three - Implementation
How hypermedia will/should be used in education in relation to the role of the teacher, the environment, and the student.

Section Four - Design
Components and Parts of Hypermedia
What the structural components of hypermedia are (button, field, graphics, foreground, background, etc.), how each component is created and manipulated, and how each component functions in a hypermedia environment.

Creation of a Hypermedia environment
The steps taken to create a non-linear, multi-nodal, interactive educational environment.

Evaluation of a hypermedia environment
Criterion for evaluation of hypermedia products to determine the educational soundness and applicability of the product.
Test Objectives
Compiled May 26, 1991

Section One - Definition
A definition of what "hypermedia" is, the characteristics of hypermedia, and the differences and similarities between hypermedia and corresponding terminology (such as multimedia).

Objectives
The students will:

be able to define hypermedia

be able to define what a hypermedia environment is and what the possible components of that environment are.

be able to compare and contrast the related terminology associated with hypermedia.

be able to descriptively relate hypermedia and multimedia.

Section Two - Research Issues
The current research issues related to the use of hypermedia in education drawn from the prescribed articles in the workshop manual.

Objectives
The students will:

be able to describe the research issues related to the definition of hypermedia

be able to describe the research issues related to the role of hypermedia in education

be able to describe the research issues related to hypermedia instructional design

be able to describe the research issues relating to the pros and cons of hypermedia educational usage as supported by the literature
Section Three - Implementation
How hypermedia will/should be used in education in relation to the role of the teacher, the environment, and the student.

Objectives
The student will:

understand the correct hardware assembly procedures for a hypermedia system

be able to correctly operate all hardware of a hypermedia system

be able to identify a variety of roles of hypermedia in the educational classroom

be able to identify the appropriate role of the teacher and student in a hypermedia environment

Section Four - Design
Components and Parts of Hypermedia
What the structural components of hypermedia are (button, field, graphics, foreground, background, etc.), how each component is created and manipulated, and how each component functions in a hypermedia environment.

Creation of a Hypermedia environment
The steps taken to create a non-linear, multi-nodal, interactive educational environment.

Evaluation of a hypermedia environment
Criterion for evaluation of hypermedia products to determine the educational soundness and applicability of the product.

Objectives
The students will:

understand the definitions of non-linear, multi-nodal, and interactive as used in a hypermedia environment

be able to differentiate the fore— and background work areas and be able to place items in the appropriate area
Section Four Objectives Continued:

- be able to construct scripts at the stack and card level
- be able to construct scripts for use in fields and buttons
- understand the basic script operators for LinkWay, HyperStudio, and HyperCard
- understand the concept of a stack
- understand the concept of links and nodes
- understand the concept of layers
- be able to import and manipulate the size and position of graphics
- understand the difference between manipulated text (found in fields) and graphic text (produced using the text tool)
- be able to create a card with appropriate layout parameters
- be able to create and manipulate the size and position of buttons and fields
- understand the function of the similar tools available in LinkWay, HyperStudio, and HyperCard
- be able to outline the criteria for the evaluation of a good stack design (non-linear, interactive, multi-nodal, correct card layout, well designed scripts, sound, animation, card transition)
- be able to debug a faulty script
Read each question carefully and circle the letter that best answers the question. There is only one correct answer for each question.

1. Hypermedia and multimedia are similar in that:
   a. they both make use of multiple forms of media.
   b. they both must involve the use of a computer.
   c. both involve the use of buttons and cards for organization.
   d. inexperienced users will be unable to use them.

2. Teachers will be subjected to many changes as technology becomes a larger part of the school's curriculum. Which of the following are among these changes?
   a. a change in the role of the student
   b. the amount of daily planning time
   c. a change in the role of the teacher
   d. all of the above

3. In the creation of a HyperStudio document, the CUT command:
   a. copies the selected item to the clipboard
   b. moves the selected item to the clipboard
   c. deletes the selected item forever
   d. shrinks the selected item

4. Which of the following is not one of the three main characteristics of hypermedia systems that have great potential for learning and teaching?
   a. Hypermedia presents information in a linear form.
   b. Hypermedia an enabling environment.
   c. Hypermedia offers a high level of learner control.
   d. Hypermedia easily accesses information from a variety of media.

5. Schools will be required to undergo a metamorphosis in order to successfully integrate technology into the curriculum. Why is this so?
   a. Accreditation program requirements will change.
   b. The federal government currently requires all schools to comply with the federal school technology laws.
   c. The demands created by society and thus the needs of the students necessitate change.
   d. a and c
   e. all of the above

6. In the creation of a HyperStudio document, graphics
   a. can be created by using the Tool Menu
   b. can be copied from another card
   c. can consist of several colors
   d. all of the above
7. According to Stover, the typical structural features of hypermedia are:
   a. buttons, fields, a mouse, and relational backgrounds
   b. a mouse, buttons, a map of the environment, and windows
   c. buttons, fields, relational backgrounds, and graphics
   d. none of the above

8. According to Goodman’s “The HyperCard Handbook,” hypermedia is described as:
   a. a chain link fence with the links representing the multiple nodes of a stack
   b. an erector set of parts that allow the user to construct cognitive relationships
   c. the delivery of information in forms that go beyond the traditional list and database report methods
   d. none of the above

9. Multimedia is called hypermedia when the application becomes:
   a. interactive
   b. a cognition enhancer
   c. a computer is used
   d. more than three forms of media are used together

10. By using hypermedia, teachers:
   a. are able to construct their own applications
   b. regain the control ceded to the software company programmers
   c. provide an interactive learning environment for their students
   d. all of the above

11. An understanding of the design issues of educationally sound hypermedia is necessary to avoid:
   a. creating products that do not facilitate learning
   b. asking rhetorical questions that promote mental processing
   c. presenting too many examples in contrast to providing text rich environments
   d. a and b

12. Which of the following is not a possible use of buttons in a hypermedia document?
   a. playing of a sound
   b. controlling a laserdisk player
   c. moving to another stack
   d. turning the computer off

13. Which of the following best describes hypermedia?
   a. A multi-sensory environment in which the user is able to interact with the system and make decisions concerning the pathway of exploration.
   b. A multi-nodal, non-interactive, non-linear application making use of a variety of media sources.
   c. A system consisting of a variety of media sources that provide the user with an interactive environment for random exploration.
   d. a and b
   e. all of the above
14. Something that appears on every card is likely to be part of the:
   a. foreground  
   b. field  
   c. button  
   d. background

15. According to Marchionini, hypermedia has great potential because it
   a. provides easy access and storage of a huge collection of information in a variety of media forms  
   b. is an enabling rather than a directive environment  
   c. does not affect the roles of the teacher and student  
   d. permits the user to view the instructor's interpretation of the information presented  
   e. a and b

16. A button/field can be enlarged by:
   a. double clicking on it  
   b. dragging one of the corners  
   c. clicking on it once  
   d. grabbing it in the middle and dragging it

17. The information that is displayed on the monitor is a design characteristics called:
   a. page view  
   b. screen display  
   c. print preview  
   d. none of the above

18. The main purpose of a button is:
   a. to allow the author to type in text  
   b. to allow the author to give every card the same "look"  
   c. to allow the user to navigate through the stack(s) or pages  
   d. to provide animation within a stack

19. A mistake in text that has been produced with the text tool can be corrected:
   a. by highlighting it with the cursor and typing the correction.  
   b. by deleting the field it is in.  
   c. by deleting the button it is on.  
   d. by using the eraser.

20. Keyboard anxiety refers to:
   a. the inability to use a computer based application due to a lack of keyboarding skills.  
   b. a fear of learning to use a computer mouse  
   c. a nervous condition that prevents a student from being able to replace their keyboarding skills with mouse pointing skills  
   d. a disorientation caused by a lack of computer literacy

21. Which of the following is least likely to be found in a hypermedia environment?
   a. computer  
   b. film projector  
   c. Liquid Crystal Display  
   d. overhead projector
22. A stack is:
   a. a set of unrelated information
   b. a series of cards that represent a set of related information
   c. the layers of a card
   d. all of the above

23. Scrolling is a good technique to allow students to enter large amounts of data in one field.
   a. True
   b. False

24. Multi-nodal refers to:
   a. a stack consisting of several cards that are interconnected
   b. a single stack that branches into several stacks
   c. giving a user alternative pathways for stack exploration
   d. all of the above

25. According to Marchionini and Heller, hypermedia inherently has environmental problems that affect the user. Which of the following problems belong in this category?
   a. disorientation due to the large amounts of information available to the user
   b. distraction due to the change in teacher/student roles
   c. the difficulty encountered in hypermedia development
   d. none of the above

26. Which of the following attributes of field text can be manipulated after the text has been typed?
   a. font style
   b. type color
   c. alignment within the field
   d. none of the above
   e. a, b and c

27. Educationally sound hypermedia applications:
   a. require learner participation
   b. adapt to student's responses and tailor the lesson based on the response
   c. are entertaining
   d. are based on behavioral objectives

28. Hypermedia can be defined as
   a. an environment
   b. a concept
   c. a computer system connected to various peripherals
   d. all of the above
   e. a and c

29. Dealing with the hypermedia learning environment, which of the following is not considered a serious problem?
   a. Learner disorientation
   b. Learner distraction
   c. Technological progress
   d. Cognitive mapping
30. The most effective designs for hypermedia applications
   a. are tailored for various learning styles
   b. give the user no more than three options
   c. provide cognitive maps of the environment
   d. are based on gaming schema
   e. all of the above

31. Animation is a technique that is used:
   a. to add emphasis to an idea or topic
   b. to provide an entertainment factor
   c. for no apparent reason
   d. for demonstration purposes only

32. Hypermedia applications (require)
   a. several forms of media
   b. a computer
   c. linear access to information
   d. a and b

33. Hypermedia
   a. is an interactive environment
   b. is an information database controlled by a computer
   c. provides linear access to information
   d. all of the above

34. The most important aspect of a hypermedia environment is:
   a. random access of information
   b. interactivity
   c. the variety of forms information can take on
   d. none of the above
   e. a, b and c

35. Dealing with the hypermedia teaching environment, which of the following is not
    considered a serious problem?
   a. Creating hyperdocuments.
   c. Elimination of teaching positions
   d. Evaluating learning.

36. Hypermedia requires learner participation and/or interactivity
   a. True
   b. False

37. Hypermedia applications are most appropriately used for:
   a. presentations
   b. small group instruction
   c. individual instruction
   d. all of the above
38. According to Christopher Dede, the use of hypermedia allows the computer to:
   a. work in a cognitive partnership with the user
   b. make use of mass data storage devices
   c. increase the overload in transferring long term to short term memory
   d. a and c

39. Hypermedia is the same as multimedia except hypermedia requires a computer.
   a. True
   b. False

40. How can you determine if an object is in the background of a card?
   a. choose New Background from the HyperCard Objects menu
   b. choose Background from the HyperCard Edit menu
   c. type Command-B
   d. b and c

41. Hypermedia is
   a. an interactive environment
   b. multimedia system with non-linear access to data
   c. a database
   d. b and c
   e. all of the above

42. In order for a button to be functional, the mouse cursor must be in the form of:
   a. the Button Tool
   b. the Browse Tool
   c. the Information Tool
   d. None of the above

43. The tool that is necessary to move, cut or copy a graphic is:
   a. the Selection tool
   b. the Lasso tool
   c. the Pencil tool
   d. a and b

44. The concept of hypermedia is inclusive in the definition or concept of hypertext.
   a. True
   b. False

45. A problem decreasing the level of hypermedia use in many schools is:
   a. too much technology oriented staff development
   b. a lack of hypermedia capable technology
   c. a lack of inexpensive and applicable software
   d. none of the above

46. A microworld is a hypermedia application with specific educational objectives
   a. True
   b. False
47. If the font style within a field must be changed, the first thing to do is:
   a. double click on the field
   b. highlight the text in the field
   c. choose new field from the Objects menu
   d. choose the Field tool from the Tools menu
   e. board

48. Animation can be accomplished how in HyperCard?
   a. using a series of cards like frames of a film
   b. using an external program to produce the animation
   c. controlling the pace of a sequence of cards in a script
   d. all of the above

49. Pressing what key will move the cursor from one field to the next?
   a. return
   b. enter
   c. tab
   d. shift-return

50. The difference between hypermedia and hypertext is that hypermedia:
   a. has non-linear access to data
   b. uses a computer
   c. has information represented in a variety of forms
   d. is more interactive
   e. is an information database

51. In order to write comments that are not a part of a hypertalk script, the comment must be preceded by:
   a. a tab
   b. two hyphens
   c. five spaces
   d. an asterisk

52. Which of the following statements is true about hypertalk variables
   a. the global variable is available to handlers anywhere
   b. the local variable is available to any card in a particular stack
   c. the global variable only needs to be declared in one stack for all of the stacks to access it
   d. none of the above

53. The use of hypermedia in education will require teachers to:
   a. change roles in the classroom
   b. use different teaching techniques than they currently use
   c. participate in hypermedia specific staff development programs
   d. a and c

54. Which of the following is the correct way to write a script for a visual effect?
   a. visual iris open effect on mousedown
   b. visual effect iris open
   c. visual iris open slowly
   d. b and c
55. Which of the following button scripts will enable you to view the next card of a stack?
   a. On mouseup
      go to next card
      end mouseup
   b. On Openstack
      go to next card
      end Openstack
   c. On mouseup
      goto next card
      end mouseup
   d. On OpenCard
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Read each question carefully and circle the letter that best answers the question. There is only one correct answer for each question.

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    a. A multi-sensory environment in which the user is able to interact with the system and make decisions concerning the pathway of exploration.
    b. A multi-nodal, non-interactive, non-linear application making use of a variety of media sources.
    c. A system consisting of a variety of media sources that provide the user with an interactive environment for random exploration.
    d. a and c

12. Something that appears on every card/page is likely to be part of the:
    a. foreground
    b. field
    c. button
    d. background

13. As stated in the literature, hypermedia has great potential because it
    a. is an enabling rather than a directive environment
    b. does not affect the roles of the teacher and student
    c. permits the user to view the instructor's interpretation of the information presented
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16. The main purpose of a button is:
   a. to allow the author to type in text
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   a. by highlighting it with the cursor and typing the correction.
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   a. a set of unrelated information
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20. In a well designed hypermedia environment, what is the best technique that will allow
    students to enter large amounts of data about related topics into a stack or folder?
    a. Use of a scrolling field.
    b. Using multiple cards or pages that contain a field in the background.
    c. Using several fields on a single card or page.
    d. None of the above.

21. Multi-nodal refers to:
    a. a stack or folder consisting of several cards or pages that are interconnected
    b. a single stack or folder that branches into several stacks or folders
    c. giving a user alternative pathways for stack or folder exploration
    d. all of the above

22. Hypermedia inherently has environmental problems that affect the user. Which of the
    following problems belong in this category?
    a. disorientation due to the large amounts of information available to the user
    b. distraction due to the change in teacher/student roles
    c. the difficulty encountered in hypermedia development
    d. none of the above
23. Which of the following attributes of field text can be manipulated after the text has been typed?
   a. font style
   b. type color
   c. alignment within the field
   d. all of the above

24. Educationally sound hypermedia applications
   a. require learner participation
   b. adapt to student's responses and tailor the lesson based on the response
   c. are based on behavioral objectives
   d. all of the above

25. When dealing with the hypermedia learning environment, which of the following is not considered a serious problem?
   a. Learner disorientation
   b. Learner distraction
   c. Technological progress
   d. None of the above

26. The most effective designs for hypermedia applications
   a. are tailored for various learning styles
   b. give the user no more than three options
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   a. work in a cognitive partnership with the user
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33. How can you determine if an object is in the background of a card?
   a. choose New Background from the HyperCard Objects menu
   b. choose Background from the HyperCard Edit menu
   c. type Command-B
   d. b and c

34. Hypermedia is
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35. In order for a button to be functional, the mouse cursor must be in the form of:
   a. the Button Tool
   b. the Browse Tool
   c. the Information Tool
   d. None of the above

36. The tool that is necessary to move, cut or copy a graphic is:
   a. the Selection tool
   b. the Lasso tool
   c. the Pencil tool
   d. a and b

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   a. too much technology oriented staff development
   b. a lack of hypermedia-capable technology
   c. a lack of inexpensive and applicable software
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45. Which of the following is the correct way to write a hypertalk script for a visual effect?
   a. visual iris open effect on mousedown
   b. visual effect iris open
   c. visual iris open slowly
   d. b and c
Read each question carefully and circle the letter that best answers the question. There is only one correct answer for each question.

1. Teachers will be subjected to many changes as technology becomes a larger part of the school's curriculum. Which of the following are among these changes?
   a. a change in the role of the student
   b. a temporary increase in the amount of daily planning time
   c. a change in the role of the teacher
   d. all of the above

2. In the creation of a HyperStudio document, the CUT command:
   a. copies the selected item to the clipboard
   b. deletes and moves the selected item to the clipboard
   c. deletes the selected item forever
   d. shrinks the selected item

3. Which of the following is not one of the three main characteristics of educationally sound hypermedia systems?
   a. Hypermedia presents information in a linear form.
   b. Hypermedia is an enabling environment.
   c. Hypermedia offers a high level of learner control.
   d. Hypermedia easily accesses information from a variety of media.

4. Schools will be required to undergo a metamorphosis in order to successfully integrate technology into the curriculum. Why is this so?
   a. Accreditation organizations currently require the integration of technology.
   b. The federal government currently requires all schools to comply with the federal school technology laws.
   c. The demands created by society and thus the needs of the students necessitate change.
   d. a and c

5. In the creation of a HyperStudio document, graphics
   a. can be created by using the Tool Menu
   b. can be copied from another card/page
   c. can consist of several colors
   d. all of the above

6. According to the literature, the typical structural features of hypermedia are
   a. buttons, fields, a mouse, and relational backgrounds
   b. a mouse, buttons, a map of the environment, and windows
   c. buttons, fields, relational backgrounds, and graphics
   d. none of the above

7. Multimedia is called hypermedia when the application becomes
   a. interactive
   b. a cognition enhancer
   c. a computer is used
   d. more than three forms of media are used together
8. By using hypermedia, teachers
   a. have the capability to construct their own applications
   b. regain the control ceded to the software company programmers
   c. provide an interactive learning environment for their students
   d. all of the above

9. An understanding of the design issues of educationally sound hypermedia is necessary to avoid
   a. creating products that do not facilitate learning
   b. asking rhetorical questions that promote mental processing
   c. presenting too many examples in contrast to providing text rich environments
   d. a and b

10. Which of the following is not a possible use of buttons in a hypermedia document?
    a. playing of a sound
    b. controlling a laserdisk player
    c. moving to another stack/folder
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   a. visual iris open effect on mousedown
   b. visual effect iris open
   c. visual iris open slowly
   d. b and c

46. Which of the following button hypertalk scripts will enable you to view the next card of a stack?
   a. On mouseup
      go to next card
      end mouseup
   b. On Openstack
      go to next card
      end Openstack
   c. On mouseup
      goto next card
      end mouseup
   d. On OpenCard
      goto next card
      end OpenCard
47. Which of the following is the correct way to connect a laserdisk player, CD-ROM, printer, and a Macintosh computer?
APPENDIX B

INDIVIDUAL STAGES OF CONCERN PROFILES AND INTERPRETATIONS
Pretest: The levels of stage 0, 1, and 2 show the typical non-user. The individual is not concerned about the innovation and has little information about it. This combination leads to the heightened stage 2 concerns about the demands of the innovation and learning about it. Stage 5 concerns are very high in relation to stage 0, 1, or 2 concerns.

Primary Posttest: The user has moved to a stage 1 concern level. The drop in the stage 0 level indicates an increase in awareness and concern about the innovation. The level of the personal concerns has dropped significantly. The level of stage 5 concerns is slightly higher than in the pretest.

Secondary Posttest: Subject A shows significant changes at stages 0, 2, 3, 4, and 6. The high stage 0 score indicates a lack of concern about the innovation. The subject shows a very significant drop in intensity at stages 2 and 4. This drop in personal and consequence concerns would coincide with the lack of concern about the innovation. The subject exhibits a significant increase in management concerns.
Pretest: Subject B is a typical non-user that is interested in and desires more information regarding the innovation. Personal and managerial concerns are low showing a lack of experience concerning the innovation. The high stage 5 concerns reflect the collaborative concerns of the individual which is typical for the study group.

Primary Posttest: Subject B shows a significant decrease in stage 0 concerns with an increase in stage 1 concerns. This follows the anticipated progression of concerns due to experience and exposure to an innovation. The lower stage 0 indicates that this individual is more concerned about the innovation and the higher stage 1 concerns relate to the desire for more information. Personal concerns are still low and the collaborative concerns remain high for this individual.

Secondary Posttest: The subject’s concerns have decreased in intensity at all stages except stage 5. The collaborative concerns of this individual have
increased significantly. Other concerns have are consistent with the results found in the first post administration. The stage 2 concerns are high in relation to the other stages indicating the subject's concern about the demands of the innovation and potential resistance to its adoption. Even with lower intensity levels, this subject appears to desire more information about the innovation in order to be able to work with and dispense information to other peers.

Subject C

Pretest: The individual is a beginning user of the innovation. The high stage 1 concerns indicate that this subject is in the process of gathering information about the innovation required by the lack of knowledge indicative of high stage 0 levels. The later stages of concerns taper off indicating the lack of knowledge and experience with the innovation.

Primary Posttest: The subject’s results show a significant shift to a stage 2 level of concern. The drop in stage 1 concerns is indicative of the increase in knowledge and experience from the workshop. Stage 2 and 3 concerns indicate
that the subject is assessing the demands placed on themselves and how to manage the innovation. The stage 5 collaborative concerns also show a significant increase. Potentially, the change in the stage 1 and 2 levels of concern could represent resistance to the innovation.

Secondary Posttest: The difference found between stages 1 and 2 has declined indicating lowered resistance. The stage 3 concerns are significantly higher; typical of the progression to that of a stage 3 user. This individual is primarily concerned with the management issues relative to the innovation.

Subject D

Pretest: This is a new user requiring more information about the innovation and its personal demands. The personal concerns are high enough to affect the need for more information or learning about the innovation. The lower concerns at stages 3 through 6 are typical of a new user.

Primary Posttest: The user is still at a heightened level of concern at stage 1 and 2. The user still shows high personal concern as related to the desire to
gain more information about the innovation, but not at the intense level found in the pretest.

Secondary Posttest: The intensity level of the stage 6 concerns has increased significantly. The subject's concerns have not shifted significantly, possibly indicating a lack of understanding of the innovation.

Subject E

Pretest: Subject E exhibits high concerns at stages 0, 1, 3, and 5. This is a beginning user. The subject requires more information about the innovation and has concerns based on the management and collaborative work with the innovation. The low stage 6 is indicative of a lack of understanding about the innovation.

Primary Posttest: Subject E has increased personal concerns, while maintaining high concerns at stages 0, 1, 3, and 5. The increase in level of concern at stage 2 might suggest the beginning of a shift to personal concerns from stage 1.
Secondary Posttest: The concerns of this subject have shifted dramatically to that of a stage 2 user. The high intensity levels found at stages 1, 2, and 3 indicate that the individual is trying to find appropriate ways to learn about and manage the innovation that do not conflict with personal time and convictions. Stage 5 concerns about diffusion of this information to peers is still high.

Subject F

Pretest: Subject F is a non-user that shows little concern or knowledge of the innovation and is in need of more information about the innovation. Other concerns are significantly lower with the exception of stage 5. The low concern level found at stage 6 is caused by the lack of knowledge concerning the innovation. Answers to questions 2 and 20 indicate the individual was unaware of or not concerned with the educational practices and options related to the use of the innovation. The low stage 6 concerns are explained by the multiple irrelevant ratings made by the subject on the related statements. This could be due to a lack of knowledge about the innovation.
Primary Posttest: The subject shows a significant drop in stage 0 concerns indicating the increase in experience and concern about the innovation. The high stage 1 concerns indicate that this user still requires more information about the innovation. Stage 3 and 5 concerns have increased significantly indicating the primary focus of the informational gathering.

Secondary Posttest: Concern levels for this subject have remained stable with the exception of stage 2 or personal concerns. The subject is no longer highly concerned about the personal demands of the innovation. This concern has overshadowed the concern about the effects of student use and involvement causing a reduction in stage 4. The high concern levels at stages 1 and 5 and the low level at stage 0 indicate that this individual has become more experienced with the innovation and is in the process of gathering information concerning peer interaction and collaboration.

Subject G
Pretest: Subject G is a user of the innovation as indicated by the low stage 0 and high stage 1 concerns. The low levels of stage 0 indicate the increased concerns of the individual. This individual is a stage 1 user that is concerned about management of the innovation and collaboration with peers. The high concerns at stage 5 (Collaboration) are similar to the group average.

Primary Posttest: The concerns of the subject indicate the beginnings of a progressive shift to that of a stage 2 user. The stage 1 concerns are decreasing and stage 2 concerns are on the rise. This is indicative of an individual who is concerned about the personal commitment aspects of the innovation. Stage 5 concerns about peer collaboration are maintained while the management concerns of stage 3 drop significantly. The rise in personal concerns may contribute to the high stage 6 concerns which indicate the subject is looking for alternatives to the innovation.

Secondary Posttest: The individual concerns show an unusual pattern of regression to that of a stage 1 user. The stage 0 concerns have increased significantly indicating the individual has a lack of concern or interest about the innovation. Stage 2 concerns have dropped, while stage 1 concerns have increased significantly. The individual is in need of more information about the innovation, but the stage 0 concerns would indicate a lack of interest in getting the information or working further with the innovation.
Pretest: A typical non-user. This individual is aware of the innovation, has little knowledge or concern about the innovation. The raised stage 1 concerns indicate the need for more information about the innovation. The lower levels of concern at the other stages indicate the lack of information or knowledge about the innovation and its effects.

Primary Posttest: The concerns of the subject have shifted to stage 2 and 3. The 1-2 split could indicate some resistance to the innovation as personal concerns are elevated over the desire for knowledge. The subject has gained experience with the innovation and is questioning the personal and management aspects of the innovation as indicated by the high stage 3 concerns. A slight “tail up” at the stage 5 and 6 area is indicative of resistance to the innovation and its adoption/diffusion.

Secondary Posttest: The subject continued to show resistance to the innovation as indicated by the 1-2 split and 5-6 tail-up. The management
concerns have declined significantly as the subject continues to reject the innovation.

Subject I

Pretest: Subject I shows low stage 0 and high stage 1 concerns. This individual is a beginning user in the process of finding out more about the innovation. The low stage 0 is indicative of high concerns about the innovation and leads to the high stage 1 information search. This subject shows the high stage 5 collaborative concerns found in the general population of this sample. The statements that contribute to the low concerns found at stages 3, 4, and 6 are marked irrelevant indicating the lack of knowledge about the innovation.

Primary Posttest: Subject I shows a significant decrease in stage 0 concerns and heightened concerns at stage 1. The subject's concerns indicate the increase in experience and the need for more information concerning the innovation. The high stage 5 concerns and the moderate personal concerns indicate a lack of
knowledge or experience with the innovation and its effects on students, peers, and themselves.

Secondary Posttest: The subject demonstrates progressive change in the development of concerns. The intensity levels of stage 1 and 2 are declining as stages 3 and 4 increase. This indicates that the individual is becoming more experienced with the innovation and is now addressing logistical problems associated with management and the ensuing effects of the innovation upon students in the classroom. Of interesting note is the decline in intensity of stage 5 concerns related to collaboration.

Subject J

Pretest: The subject is a current user of the innovation. Stage 2 through 4 are moderately high with a peak at stage 5. The individual’s concerns at stage 2 and stage 3 indicate the subject is in the transition from a stage 2 to stage 3 user. The relative intensity of the concerns in stages 2 through 5 indicates the subject
could be aware of many of the potential problems involved with this type of innovation.

Primary Posttest: The subject shows a significant drop in the concerns related to self. The peaks occur at stages 3, 4, and 5 indicating concerns about the application of the innovation. The lowered concern at stage 2 indicates the transition to a stage 3 user and the corresponding concerns about management of the innovation.

Secondary Posttest: The level of intensity of the stage 3 and 5 concerns are maintained. Stage 4 concerns have decreased. This indicates that the individual is more concerned about management of the innovation than its effects. The high stage 5 concerns indicate the individual is in need of information relating to diffusion of information about the innovation to peers.

Pretest: Subject K is a beginning or stage 1 user. Stage 2 is beginning to supercede stage 1 as the primary area of concern. This indicates the increased
concerns about the effects of the innovation on the individual. Stage 5 concerns are high and are similar to the group average in intensity.

Primary Posttest: The individual has progressed to management-oriented concerns as indicated by the heightened intensity at stage 3. The pattern found at stages 0, 1, and 2 are nearly identical to the pretest. The user has a "tail up" orientation at stages 5 and 6 indicating some resistance to the innovation.

Secondary: The subject profile is progressing to that of a stage 4 user. This is indicated by the decline of stage 3 concerns and an increase in stage 4 concerns. The maintenance of stage 1 and 2 levels represents the continued desire for information about the innovation and the resulting demands on the subject.

Pretest: Subject L is a non-user that is in need of more information concerning the innovation. The high stage 0 concerns indicate a lack of concern about the innovation. The high concern at stage 1 is indicative of the subject's...
lack of knowledge and desire for information. This subject has high collaboration concerns that are typical of this group.

**Primary Posttest:** Subject L is showing a gradual, but significant shift towards stage 2 concerns. The stage 5 concerns related to collaborative work remain high. The stage 0 concerns dropped markedly on this test as compared to the pretest. The drop in stage 0 combined with the individual’s development as a user indicates an increase in concern about the innovation. The individual is concerned primarily with acquiring information about the demands that the innovation will place upon them personally.

**Secondary Posttest:** As subject L has gained experience using innovation, the concerns about its effect on their personal commitment have decreased significantly. The subject is a stage 1 user that is now in the process of finding information about the effects of the innovation on the students and peer collaboration. The lower personal and management concerns indicate the subject is not threatened by the innovation and is probably trying to determine the appropriate application of the innovation at work. The stage 6 concern intensity has dropped significantly indicating the subject is not looking for or viewing other innovations as a replacement.
Subject M

Pretest: This subject shows a high concern at stage 1 and 3. The moderately level of concern at stage 0 would indicate the subject has increased levels of concern about the innovation and desires more information. This individual is in the process of gathering information about the management of the innovation. The statements that contribute to the low concerns found at stages 2, 4, and 6 indicate the lack of knowledge about the innovation as the majority were marked irrelevant.

Primary Posttest: The exposure to the innovation during the workshop has provided some information to the subject, but has raised other questions. The stage 1 level is still peaked with an increase in stage 3 concerns. The subject requires more information pertaining to the management of the innovation. The statements that contribute to the low concerns found at stages 2, 4, 5, and 6 again indicate the lack of knowledge about the innovation as the majority were marked irrelevant.
Secondary Posttest: The concerns of the individual remain much the same as on the primary posttest. The very low concern levels at stages 2, 5, and 6 have increased significantly. Stages 5 and 6 show the tailing-up pattern of an individual that potentially is a resistor to the adoption of the innovation. The subject's primary concerns are still with the management of the innovation.

Subject N

Pretest: The high level of stage 0 and stage 1 concerns indicate that this individual is a non-user that is aware and is in need of information about the innovation. The high stage 0 levels indicate the low concerns due to a lack of informational knowledge concerning the innovation. Later stages taper off indicating the lack of knowledge and experience with the innovation.

Primary Posttest: The subject's concerns have progressed to that of a stage 1 user. The stage 0 concerns have dropped significantly showing the increase in concern and desire for information. The concerns at stages 3 and 5 are higher in relation to stage 1. The individual is more experienced with the innovation, but
is now requiring more information in order to assess the management and collaborative efforts that will be required.

Secondary Posttest: Subject N exhibits a progression of concerns from stage 1 to stage 2. This is indicative of increased concern about the personal demands the innovation will place on the subject. The subject shows a slight tail-up tendency at stages 5 and 6. This combination of factors might lead to the conclusion that the subject is concerned about the demands of the innovation, but may not have the time or desire to invest in its adoption.

Pretest: The subject is a non-user or beginning user that seems to have little knowledge or concerns about the innovation. Some minor peaks occur at stage 3 and stage 5 indicating the potential areas of informational need by the subject. The statements represented by the low level of concern at stage 4 indicates the subject is concerned about student involvement, but is not concerned about the feedback received from the students. In addition, the low
stage 6 concerns are representative of the subject's unawareness of existing or potential alternatives to the innovation.

Primary Posttest: The subject is shifting towards stage 1 concerns. Stage 0 decreased markedly indicating the increased concern about the innovation. The elevated stage 2 and 3 indicate the shift towards personal and managerial concerns in the actual use of the innovation.

Secondary Posttest: The lower level of stage 0 and 1 demonstrates an increased concern about and desire for information pertaining to the innovation. The subject's desire for information is focused on management and collaboration issues. Stage 5 levels still indicate the concerns about collaboration with peers.

Subject P

Pretest: The heightened level of concern at stage 1 indicates that this subject is aware of the innovation and may have some experience with it. The level of stage 0 would indicated that the level of experience with the innovation
is rather limited and the user has low concerns about the innovation. The subject has high concerns at stage 5 as found in the group results.

Primary Posttest: The subject concerns are higher at stage 3 and 5. Stage 1 and 2 have decreased significantly. The individual is requiring more information about the innovation and is concerned about the management aspect of the innovation. The high stage 5 is typical for this group.

Secondary Posttest: The profile parallels that of the primary posttest. The subject still requires more information about the innovation. The emphasis of their search is focused on management and collaboration concerns.
APPENDIX C

TEST INSTRUMENTS
Teacher Attitudes Toward Computers and Computer-Related Technologies

To what extent do each of the following statements characterize your attitudes toward computers and computer-related technologies. Using the categories below, indicate the extent to which you agree or disagree with each statement by circling your response.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Strongly Disagree</td>
<td>Disagree</td>
<td>Undecided</td>
<td>Agree</td>
<td>Strongly Agree</td>
</tr>
<tr>
<td>1</td>
<td>I think that computers make my professional work more difficult</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>I am comfortable in using computer-related technologies for my own work</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>I think computers make work more enjoyable</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>It has been a struggle for me to learn how to use a computer successfully</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>Teachers do not need to know how to use a computer</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>Computer-related technologies are an important part of the future for improving the quality of education</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>I lack confidence in using a computer to complete my work</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>8</td>
<td>I would like to improve my skills in the use of computer-related technologies</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>9</td>
<td>I don't feel threatened by computers</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>10</td>
<td>The computer is useful for accessing and organizing information</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>11</td>
<td>Word processing makes writing more difficult</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>12</td>
<td>Computers are valuable tools that can be used to improve the quality of education</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>13</td>
<td>Computer-related technologies should be used to improve learning throughout the curriculum</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>14</td>
<td>Computers are useful for teaching thinking and problem solving skills</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>15</td>
<td>Computer-related technologies should be used by teachers more than they are now</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>
16. My teaching is positively affected when using computer-related technologies ............................................................. 1 2 3 4 5

17. I do not feel comfortable using computer-related technologies in my teaching ........................................................................ 1 2 3 4 5

18. Computer-related technologies are unnecessary luxuries in most school settings ............................................................ 1 2 3 4 5

19. Computers are of little value in education because they can be used to teach only one or two subjects ........................................... 1 2 3 4 5

20. The computer helps me obtain individual diagnostic information from student test scores .............................................................. 1 2 3 4 5

21. Overall, I think the computer is a very important tool for instruction in my classroom ............................................................. 1 2 3 4 5

22. Computer-related technologies are of little value in the classroom because they are too difficult to use ........................................... 1 2 3 4 5

23. I would like to use computer-related technologies more in my teaching ..................................................................... 1 2 3 4 5
SoC

Concerns Questionnaire

Name (Optional) ________________________________

Date Completed ________________________________

It is very important for continuity in processing this data that we have a unique number that you can remember. Please use:

Last four digits of your Social Security No. _______ _______ ______

The purpose of this questionnaire is to determine what people who are using or thinking about using various programs are concerned about at various times during the innovation adoption process. The items were developed from typical responses of school and college teachers who ranged from no knowledge at all about various programs to many years experience in using them. Therefore, a good part of the items on this questionnaire appear to be of little relevance or irrelevant to you at this time. For the completely irrelevant items, please circle “0” on the scale. Other items will represent those concerns you do have, in varying degrees of intensity, and should be marked higher on the scale, according to the explanation at the top of each of the following pages.

For example:

This statement is very true of me at this time. 0 1 2 3 4 5 6 7

This statement is somewhat true of me now. 0 1 2 3 4 5 6 7

This statement is not at all true of me at this time. 0 1 2 3 4 5 6 7
This statement seems irrelevant to me. 0 1 2 3 4 5 6 7

Please respond to the items in terms of your present concerns, or how you feel about your involvement with Hypermedia. We do not hold to any one definition of this program, so please think of it in terms of your own perceptions of what it involves. Phrases such as "this approach," and "the new system" all refer to Hypermedia. Remember to respond to each item in terms of your present concerns about your involvement or potential involvement with Hypermedia.

Thank you for taking time to complete this task.

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<table>
<thead>
<tr>
<th>0</th>
<th>Irrelevant</th>
<th>1</th>
<th>Not true of me now</th>
<th>2</th>
<th>Somewhat true of me now</th>
<th>3</th>
<th>Very true of me now</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>I am concerned about students’ attitudes toward Hypermedia.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>2.</td>
<td>I now know of some other approaches that might work better.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>3.</td>
<td>I don’t even know what cooperative learning is.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>4.</td>
<td>I am concerned about not having enough time to organize myself each day.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>5.</td>
<td>I would like to help other faculty in their use of Hypermedia.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>6.</td>
<td>I have a very limited knowledge about Hypermedia.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>7.</td>
<td>I would like to know the effect of reorganization on my professional status.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>8.</td>
<td>I am concerned about conflict between my interests and my responsibilities.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>9.</td>
<td>I am concerned about revising my use of Hypermedia.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>10.</td>
<td>I would like to develop working relationships with both our faculty and outside faculty using Hypermedia.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>11.</td>
<td>I am concerned about how cooperative learning affects students.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>12.</td>
<td>I am not concerned about cooperative learning.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>13.</td>
<td>I would like to know who will make the decisions in use of Hypermedia.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>14.</td>
<td>I would like to discuss the possibility of using Hypermedia.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>15.</td>
<td>I would like to know what resources are available if we decide to adopt cooperative learning.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>16.</td>
<td>I am concerned about my inability to manage all that Hypermedia requires.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>17.</td>
<td>I would like to know how my teaching is supposed to change.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>18.</td>
<td>I would like to familiarize other departments or persons with the progress of Hypermedia.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
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<table>
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<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irrelevant</td>
<td>Not true of me now</td>
<td>Somewhat true of me now</td>
<td>Very true of me now</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19.</td>
<td>I am concerned about evaluating my impact on students.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>20.</td>
<td>I would like to revise the cooperative learning instructional approach.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>21.</td>
<td>I am completely occupied with other things.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>22.</td>
<td>I would like to modify our use of Hypermedia based on the experiences of our students.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>23.</td>
<td>Although I don’t know about cooperative learning, I am concerned about things in the area.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>24.</td>
<td>I would like to excite my students about their part in Hypermedia.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>25.</td>
<td>I am concerned about time spent working with nonacademic problems related to Hypermedia.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>26.</td>
<td>I would like to know what the use of Hypermedia will require in the immediate future.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>27.</td>
<td>I would like to coordinate my effort with others to maximize Hypermedia’s effects.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>28.</td>
<td>I would like to have more information on time and energy commitments required by Hypermedia.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>29.</td>
<td>I would like to know what other faculty are doing in the area of cooperative learning.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>30.</td>
<td>At this time, I am not interested in learning about Hypermedia.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>31.</td>
<td>I would like to determine how to supplement, enhance, or replace Hypermedia.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>32.</td>
<td>I would like to use feedback from students to change the Hypermedia program.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>33.</td>
<td>I would like to know how my role will change when I am using cooperative learning.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>34.</td>
<td>Coordination of tasks and people is taking too much of my time.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>35.</td>
<td>I would like to know how cooperative learning is better than what we have now.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

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Hypermedia Knowledge Test

Last Four Digits of your Social Security Number: ___ ___ ___ ___

Date Completed: ____________________

This purpose of this test is to evaluate what people know about hypermedia. The instrument is designed to evaluate the following areas:

- **Definition**
  A definition of what “hypermedia” is, the characteristics of hypermedia, and the differences and similarities between hypermedia and corresponding terminology (such as multimedia).

- **Research Issues**
  The current research issues related to the use of hypermedia in educational settings as described in current literature.

- **Implementation**
  How hypermedia will/should be used in education in relation to the role of the teacher, the environment, and the student.

- **Design**
  Components, the development of a hypermedia environment, and methods of evaluating hypermedia materials.

Contact: Dennis McElroy
N031 Lagomarcino
Iowa State University
Ames, IA 50011
Created: June 1991
Read each question carefully and circle the letter that best answers the question. There is only one correct answer for each question.

1. Teachers will be subjected to many changes as technology becomes a larger part of the school's curriculum. Which of the following are among these changes?
   a. a change in the role of the student
   b. a temporary increase in the amount of daily planning time
   c. a change in the role of the teacher
   d. all of the above

2. In the creation of a HyperStudio document, the CUT command:
   a. copies the selected item to the clipboard
   b. deletes and moves the selected item to the clipboard
   c. deletes the selected item forever
   d. shrinks the selected item

3. Which of the following is not one of the three main characteristics of educationally sound hypermedia systems?
   a. Hypermedia presents information in a linear form.
   b. Hypermedia is an enabling environment.
   c. Hypermedia offers a high level of learner control.
   d. Hypermedia easily accesses information from a variety of media.

4. Schools will be required to undergo a metamorphosis in order to successfully integrate technology into the curriculum. Why is this so?
   a. Accreditation organizations currently require the integration of technology.
   b. The federal government currently requires all schools to comply with the federal school technology laws.
   c. The demands created by society and thus the needs of the students necessitate change.
   d. a and c

5. In the creation of a HyperStudio document, graphics
   a. can be created by using the Tool Menu
   b. can be copied from another card/page
   c. can consist of several colors
   d. all of the above

6. According to the literature, the typical structural features of hypermedia are
   a. buttons, fields, a mouse, and relational backgrounds
   b. a mouse, buttons, a map of the environment, and windows
   c. buttons, fields, relational backgrounds, and graphics
   d. none of the above

7. Multimedia is called hypermedia when the application becomes
   a. interactive
   b. a cognition enhancer
   c. a computer is used
   d. more than three forms of media are used together
8. By using hypermedia, teachers
   a. have the capability to construct their own applications
   b. regain the control ceded to the software company programmers
   c. provide an interactive learning environment for their students
   d. all of the above

9. An understanding of the design issues of educationally sound hypermedia is necessary to avoid
   a. creating products that do not facilitate learning
   b. asking rhetorical questions that promote mental processing
   c. presenting too many examples in contrast to providing text rich environments
   d. a and b

10. Which of the following is not a possible use of buttons in a hypermedia document?
    a. playing of a sound
    b. controlling a laserdisk player
    c. moving to another stack/folder
    d. turning the computer off

11. Which of the following best describes hypermedia?
    a. A multi-sensory environment in which the user is able to interact with the system and make decisions concerning the pathway of exploration.
    b. A multi-nodal, non-interactive, non-linear application making use of a variety of media sources.
    c. A system consisting of a variety of media sources that provide the user with an interactive environment for random exploration.
    d. a and c

12. Something that appears on every card/page is likely to be part of the:
    a. foreground
    b. field
    c. button
    d. background

13. As stated in the literature, hypermedia has great potential because it
    a. is an enabling rather than a directive environment
    b. does not affect the roles of the teacher and student
    c. permits the user to view the instructor's interpretation of the information presented
    d. a and c

14. A button/field can be enlarged by:
    a. double clicking on it
    b. clicking and dragging one of the corners
    c. clicking on it once
    d. grabbing it in the middle and dragging it

15. The information that is displayed on a monitor is a design characteristic called:
    a. page view
    b. screen display
    c. print preview
    d. none of the above
16. The main purpose of a button is:
   a. to allow the author to type in text
   b. to allow the author to give every card/page the same "look"
   c. to allow the user to navigate through the stack(s) or folder(s)
   d. to provide animation within a stack/folder

17. A mistake in text that has been produced with the text tool can be corrected:
   a. by highlighting it with the cursor and typing the correction.
   b. by deleting the field it is in.
   c. by deleting the button it is on.
   d. by using the eraser.

18. Keyboard anxiety refers to:
   a. the inability to use a computer based application due to a lack of keyboarding skills.
   b. a fear of learning to use a computer mouse
   c. a nervous condition that prevents a student from being able to replace their keyboarding
      skills with mouse pointing skills
   d. a disorientation caused by a lack of computer literacy

19. A stack or folder is:
   a. a set of unrelated information
   b. a series of cards/pages that represent a set of related information
   c. the layers of a card or page
   d. all of the above

20. In a well designed hypermedia environment, what is the best technique that will allow
    students to enter large amounts of data about related topics into a stack or folder?
    a. Use of a scrolling field.
    b. Using multiple cards or pages that contain a field in the background.
    c. Using several fields on a single card or page.
    d. None of the above.

21. Multi-nodal refers to:
    a. a stack or folder consisting of several cards or pages that are interconnected
    b. a single stack or folder that branches into several stacks or folders
    c. giving a user alternative pathways for stack or folder exploration
    d. all of the above

22. Hypermedia inherently has environmental problems that affect the user. Which of the
    following problems belong in this category?
    a. disorationation due to the large amounts of information available to the user
    b. distraction due to the change in teacher/student roles
    c. the difficulty encountered in hyermedia development
    d. none of the above

23. Which of the following attributes of field text can be manipulated after the text has been
    typed?
    a. font style
    b. type color
    c. alignment within the field
    d. all of the above
24. Educationally sound hypermedia applications
   a. require learner participation
   b. adapt to student's responses and tailor the lesson based on the response
   c. are based on behavioral objectives
   d. all of the above

25. When dealing with the hypermedia learning environment, which of the following is not considered a serious problem?
   a. Learner disorientation
   b. Learner distraction
   c. Technological progress
   d. None of the above

26. The most effective designs for hypermedia applications
   a. are tailored for various learning styles
   b. give the user no more than three options
   c. provide cognitive maps of the environment
   d. all of the above

27. Animation is a technique that is used:
   a. to add emphasis to an idea or topic
   b. to provide an entertainment factor to a hypermedia presentation
   c. as an alternative to fixed graphics for the display of information
   d. a and c

28. Educationally sound hypermedia applications make use of:
   a. teacher oriented control
   b. a computer
   c. non-linear access to information
   d. a and b

29. Hypermedia
   a. is an interactive environment
   b. is a development tool-kit
   c. provides non-linear access to information
   d. all of the above

30. The most important aspect(s) of a hypermedia environment is/are:
   a. random access of information
   b. interactivity
   c. the limited variety of forms information can take
   d. a and b

31. Hypermedia applications are most appropriately used for:
   a. presentations
   b. small group instruction
   c. individual instruction
   d. all of the above
32. The use of hypermedia allows the computer to:
   a. work in a cognitive partnership with the user
   b. make use of mass data storage devices
   c. be used in much the same way that it has been used in the past
   d. none of the above

33. How can you determine if an object is in the background of a card?
   a. choose New Background from the HyperCard Objects menu
   b. choose Background from the HyperCard Edit menu
   c. type Command-B
   d. b and c

34. Hypermedia is
   a. an interactive environment
   b. multimedia system with interactive, non-linear access to data
   c. a simple database
   d. a and b

35. In order for a button to be functional, the mouse cursor must be in the form of:
   a. the Button Tool
   b. the Browse Tool
   c. the Information Tool
   d. None of the above

36. The tool that is necessary to move, cut or copy a graphic is:
   a. the Selection tool
   b. the Lasso tool
   c. the Pencil tool
   d. a and b

37. A problem decreasing the level of hypermedia use in many schools is:
   a. too much technology oriented staff development
   b. a lack of hypermedia-capable technology
   c. a lack of inexpensive and applicable software
   d. none of the above

38. A microworld is a hypermedia application that
   a. allows the user to explore and manipulate limited artificial realities
   b. gives the user a more abstract relationship with the computer
   c. provides very limited motivation levels for the learner
   d. evolved into what is today called hypertext

39. If the font style within a field must be changed, the first thing to do is:
   a. double click on the field
   b. highlight the text in the field
   c. choose new field from the Objects menu
   d. choose the Text tool from the Tools menu
40. Animation can be accomplished how in HyperCard?
   a. using a series of cards like frames of a film
   b. using an external program to produce the animation
   c. controlling the pace of a sequence of cards in a script
   d. all of the above

41. Pressing what key will move the cursor from one field to the next?
   a. return
   b. enter
   c. tab
   d. shift-return

42. In order to write comments that are not a part of a hypertalk script, the comment must be preceded by:
   a. a tab
   b. two hyphens
   c. five spaces
   d. an asterisk

43. Which of the following statements is true about hypertalk variables
   a. a global variable is available to handlers anywhere
   b. the local variable is available to any card in a particular stack
   c. the global variable only needs to be declared in one stack for all of the stacks to access it
   d. none of the above

44. The use of hypermedia in education will require teachers to:
   a. change roles in the classroom
   b. use different teaching techniques than they currently use
   c. participate in hypermedia specific staff development programs
   d. all of the above

45. Which of the following is the correct way to write a hypertalk script for a visual effect?
   a. visual iris open effect on mousedown
   b. visual effect iris open
   c. visual iris open slowly
   d. b and c

46. Which of the following button hypertalk scripts will enable you to view the next card of a stack?
   a. On mouseup
      go to next card
      end mouseup
   b. On Openstack
      go to next card
      end Openstack
   c. On mousedown
      goto next card
      end mousedown
   d. On OpenCard
      goto next card
      end OpenCard
47. Which of the following is the correct way to connect a laserdisk player, CD-ROM, printer, and a Macintosh computer?
Hypermedia Usage

We need some information about your use of hypermedia. Please circle the letter/number which best answers each question.

1. Rate your level of experience with hypermedia prior to the hypermedia workshop.

   None Beginner User Authoring Expert

2. Are you currently using hypermedia?
   a. YES
   b. NO (go to question 7)

3. How much are you using hypermedia?
   a. less than 1 time per week
   b. 1-3 times per week
   c. 3-7 times per week
   d. more than 7 times per week

4. Are you using hypermedia at work?
   a. YES
   b. NO (go to question 7)

5. How much are you using hypermedia at work?
   a. less than 1 time per week
   b. 1-3 times per week
   c. 3-7 times per week
   d. more than 7 times per week

6. How are you using hypermedia at work?
   a. demonstration to classes
   b. instructional support (tutorial, drill and practice, etc.)
   c. both
   d. other (please list) ________________

7. If you answered NO to question 2 or 4, what factors prevent you from using hypermedia?
   a. lack of interest
   b. lack of time
   c. equipment is not available
   d. do not feel comfortable using hypermedia
   e. other (please list) ________________

8. Rate the level of importance you feel hypermedia has to education/work.
   a. not important
   b. somewhat important
   c. important
   d. very important

9. How would you rate the level of importance of hypermedia in education/work compared to other innovations that you are asked to implement in your classroom or at work.
   a. hypermedia is not as important
   b. hypermedia is somewhat important
   c. hypermedia is equally important
   d. hypermedia is more important
10. Do you anticipate working with peers concerning hypermedia staff development?
   a. YES
   b. NO (go to question 12)

11. When do you anticipate your involvement with hypermedia staff development will begin?
   a. Immediately
   b. Within 2-3 months
   c. 3-6 months
   d. more than 6 months

12. If you answered NO to question 10, what factors are impeding your participation in this type of staff development?
   a. lack of interest
   b. lack of time
   c. equipment is not available
   d. other (please list) _________________

13. Are peers in your work place currently using hypermedia?
   a. YES
   b. NO (go to Support Mechanisms question 1)

14. How many peers are using hypermedia?
   a. 1-3
   b. 4-7
   c. 8-10
   d. more than 10

**Support Mechanisms**

1. Have you used the EEE bulletin board for hypermedia information exchange?
   a. YES
   b. NO (go to question 3)

2. How often do you use the EEE for hypermedia information exchange?
   a. 1-3 times per week
   b. 4-7 times per week
   c. 8-10 times per week
   d. more than 10 times per week

3. Do you have any peers that act as support personnel for hypermedia?
   a. YES
   b. NO (go to question 6)

4. What job capacity do these support personnel fill?
   ______________________

5. How often do you discuss hypermedia with the personnel listed in question 4?
   a. 1-3 times per week
   b. 4-7 times per week
   c. 8-10 times per week
   d. more than 10 times per week

6. Do you receive help from your AEA concerning hypermedia?
   a. YES
   b. NO (go to question 8)

7. How often do you receive help concerning hypermedia from AEA personnel?
   a. 1-3 times per week
   b. 4-7 times per week
   c. 8-10 times per week
   d. more than 10 times per week
8. Do you receive help from your area computer dealership concerning hypermedia?
   a. YES
   b. NO (go to question 9)

9. How often do you receive help concerning hypermedia from computer dealership personnel?
   a. 1-3 times per week
   b. 4-7 times per week
   c. 8-10 times per week
   d. more than 10 times per week

10. What level of support do you receive from your administration concerning hypermedia?

<table>
<thead>
<tr>
<th></th>
<th>None</th>
<th>Low</th>
<th>Average</th>
<th>Good</th>
<th>Excellent</th>
</tr>
</thead>
</table>
| **Local (principal)**
| Commitment to Technology |     |     |         |      |           |
| Commitment to hypermedia |     |     |         |      |           |
| Commitment to technology staff development |     |     |         |      |           |
| **Superintendent**
| Commitment to Technology |     |     |         |      |           |
| Commitment to hypermedia |     |     |         |      |           |
| Commitment to technology staff development |     |     |         |      |           |
| **School Board**
| Commitment to Technology |     |     |         |      |           |
| Commitment to hypermedia |     |     |         |      |           |
| Commitment to technology staff development |     |     |         |      |           |
| **Community**
| Commitment to Technology |     |     |         |      |           |
| Commitment to hypermedia |     |     |         |      |           |
| Commitment to technology staff development |     |     |         |      |           |

**Demographics**

1. What size of school district do you work at? (student population)
   a. less than 500
   b. 501 to 1500
   c. 1501 to 5000
   d. greater than 5000

2. Is the school district located in a single community or consolidated?
   a. single community
   b. consolidated

3. Is the technology required to create or use hypermedia available in your school district or place of work?
   a. YES
   b. NO
APPENDIX D

RESEARCH INVOLVING HUMAN SUBJECTS APPROVAL
Informatio\textasciitilde; for Review of Research Involving Human Subjects
Iowa State University
(Please type and use the attached instructions for completing this form)

Title of Project: Measuring the Effectiveness of Diffusion-Based Training with Hypermedia: A Staff Development Model

I agree to provide the proper surveillance of this project to insure that the rights and welfare of the human subjects are protected. I will report any adverse reactions to the committee. Additions to or changes in research procedures after the project has been approved will be submitted to the committee for review. I agree to request renewal of approval for any project continuing more than one year.

Dennis McElroy
Typed Name of Principal Investigator
6/7/91
Date
Signature of Principal Investigator
Curriculum and Instruction
NO31 Lagomarcino
Department
Campus Address
294-6840
Campus Telephone

Signatures of other investigators
Date
4/9/91
Relationship to Principal Investigator
Major Professor

Principal Investigator(s) (check all that apply)

\[
\begin{array}{c}
\square \text{ Faculty} \\
\square \text{ Staff} \\
\checkmark \text{ Graduate Student} \\
\square \text{ Undergraduate Student}
\end{array}
\]

Project (check all that apply)

\[
\begin{array}{c}
\square \text{ Research} \\
\checkmark \text{ Thesis or dissertation} \\
\square \text{ Class project} \\
\square \text{ Independent Study (490, 590, Honors project)}
\end{array}
\]

Number of subjects (complete all that apply)

\[
\begin{array}{c}
40 \# \text{ Adults, non-students} \\
20 \# \text{ ISU student} \\
\_ \# \text{ minors under 14} \\
\_ \# \text{ minors 14-17}
\end{array}
\]

Brief description of proposed research involving human subjects: (See instructions, Item 7. Use an additional page if needed.)

\[
\text{(See attached sheet)}
\]

(Please do not send research, thesis, or dissertation proposals.)

Informed Consent: 
\[
\begin{array}{c}
\checkmark \text{ Signed informed consent will be obtained. (Attach a copy of your form.)} \\
\square \text{ Modified informed consent will be obtained. (See instructions, item 8.)}
\end{array}
\]
9. Confidentiality of Data. Describe below the methods to be used to ensure the confidentiality of data obtained. (See instructions, item 9.)

Identification of individual subjects will not be necessary for the purpose of this study. The researcher will use the last four digits of the participant's social security number for correlation of data from the various instruments. The numbers will be removed as soon as all data is collected and properly matched.

10. What risks or discomfort will be part of the study? Will subjects in the research be placed at risk or incur discomfort? Describe any risks to the subjects and precautions that will be taken to minimize them. (The concept of risk goes beyond physical risk and includes risks to subjects' dignity and self-respect as well as psychological or emotional risk. See instructions, item 10.)

Subjects in the study will not be placed at risk. Participation is voluntary and will not influence the course grade in any way. Subject identification is not necessary for this study. The four digit social security number used for correlation of data will be removed to maintain anonymity of the subjects.

11. CHECK ALL of the following that apply to your research:
   - A. Medical clearance necessary before subjects can participate
   - B. Samples (Blood, tissue, etc.) from subjects
   - C. Administration of substances (foods, drugs, etc.) to subjects
   - D. Physical exercise or conditioning for subjects
   - E. Deception of subjects
   - F. Subjects under 14 years of age and/or Subjects 14 - 17 years of age
   - G. Subjects in institutions (nursing homes, prisons, etc.)
   - H. Research must be approved by another institution or agency (Attach letters of approval)

If you checked any of the items in 11, please complete the following in the space below (include any attachments):

Items A - D. Describe the procedures and note the safety precautions being taken.

Item E. Describe how subjects will be deceived; justify the deception; indicate the debriefing procedure, including the timing and information to be presented to subjects.

Item F. For subjects under the age of 14, indicate how informed consent from parents or legally authorized representatives as well as from subjects will be obtained.

Items G & H. Specify the agency or institution that must approve the project. If subjects in any outside agency or institution are involved, approval must be obtained prior to beginning the research, and the letter of approval should be filed.
Checklist for Attachments and Time Schedule

The following are attached (please check):

☐ Letter or written statement to subjects indicating clearly:
  a) purpose of the research
  b) the use of any identifier codes (names, #’s), how they will be used, and when they will be removed (see Item 17)
  c) an estimate of time needed for participation in the research and the place
  d) if applicable, location of the research activity
  e) how you will ensure confidentiality
  f) in a longitudinal study, note when and how you will contact subjects later
  g) participation is voluntary; nonparticipation will not affect evaluations of the subject

☐ Consent form (if applicable)

☐ Letter of approval for research from cooperating organizations or institutions (if applicable)

☐ Data-gathering instruments

Anticipated dates for contact with subjects:
First Contact  Last Contact
6/17/91          9/30/91
Month / Day / Year

If applicable: anticipated date that identifiers will be removed from completed survey instruments and/or audio or visual tapes will be erased:
10/2/91
Month / Day / Year

Signature of Departmental Executive Officer  Department or Administrative Unit

Decision of the University Human Subjects Review Committee:

☑ Project Approved  ☐ Project Not Approved  ☐ No Action Required

Patricia M. Keith
Name of Committee Chairperson