Utilization and integration of technology by teachers: A case study

Dawn Shipley Basinger
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UMI
UTILIZATION AND INTEGRATION OF TECHNOLOGY

BY TEACHERS: A CASE STUDY

by

Dawn Shipley Basinger, B.S., M.Ed.

A Dissertation Presented in Partial Fulfillment
of the Requirements for the Degree
Doctor of Education

COLLEGE OF EDUCATION
LOUISIANA TECH UNIVERSITY

November 2000
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Date
LOUISIANA TECH UNIVERSITY
THE GRADUATE SCHOOL

November 6, 2000
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We hereby recommend that the thesis/dissertation prepared under our supervision by Dawn Shipley Basinger
entitled Utilization and Integration of Technology by Teachers: A Case Study
be accepted in partial fulfillment of the requirements for the Degree of

Doctor of Education

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Director of Graduate Studies

Director of the Graduate School

Dean of the College
The purpose of this study was to investigate the learning process of teachers as they begin to implement an innovation. The research problem was based on the need to understand better the processes by which teachers come to integrate technology into their instructional practices. The Concerns-Based Adoption Model (Hall, Wallace, & Dossett, 1973) provided the conceptual framework for facilitating change in teachers’ use of technology to support instructional practices. The constructivist approach to learning characterized the setting for the courses—Introduction to Technology for Teachers (ITT) and Software Applications, Teaching Methods, and Software Development for Teachers (AMDT). Teachers learned basic computer operations/concepts and applied them for their own professional growth, productivity, and instructional practices.

This study required a methodology that allowed for individual thought and expression to be recorded and analyzed. Qualitative methods were of particular value in view of the fact that comments reveal how people come to understand what they experience (Stake, 1995). Triangulation (Denzin, 1989, p. 13) of multiple data assisted in strengthening the general findings.

The study focused on the following questions:

1. How do teachers’ stages of concerns about technology change after completing ITT and AMDT?
2. How do teachers’ levels of technology use change after completing ITT and AMDT?

3. How do teachers’ integrate technology after completing ITT and AMDT?

Findings revealed that teachers’ stages of concerns and levels of use were changing from "self" concerns and use to "task and impact" concerns and use. Teachers were moving from "thinking about how to use" technology to "using" technology to meet their needs. Stage of concern interventions were found to facilitate teachers’ changes. Effective technology integration was found to be accomplished when each teacher identified, designed, developed, and delivered his or her own meaningful application. These findings may provide others with new perspectives in studying, facilitating, and sustaining teachers’ changes in instructional practices supported by technology.
DEDICATION

First, this dissertation is dedicated to my husband, Ricky Glen. Thank you for your support, love, and devotion. You made this achievement possible. Second, to my children, Eddie and Casey, I thank you for the much needed entertainment, research assistance, and love. Finally, to my parents, Bert and Chris Shipley, I thank you for your faith, encouragement, and love. I love you all very much.
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Many thanks go to the teachers who participated in this study. I would not have been able to complete this dissertation without their willingness to share their trials and tribulations while learning to use technology.

Finally, I would like to acknowledge Brenda Sanderson for her assistance in producing the final copy of the dissertation.

Thank you all so much.
CHAPTER 1

THE PROBLEM

Technology continues to play an increasingly prominent role in society and education (Kent & McNergney, 1999). Nearly 20 years ago, *A Nation at Risk* (1983) determined technology to be a basic skill needed to function in society. In 1991 and 1992, the Secretary of Labor's Commission on Achieving Necessary Skills (SCANS) called on the American educational system to better prepare students for the roles of workers, parents, and citizens by identifying technology and thinking skills as components necessary to succeed in the workplace. The Goals 2000: Educate America Act (1994), amended in 1996, reinforced technology's role by declaring it as one mechanism for improving education. Recently, a report conducted by *Education Week* (in collaboration with the Milken Exchange on Education Technology) on education technology and reform in schools concluded that regardless of who is placing the demand for technology, billions of dollars are being spent with little research to provide conclusive evidence that teaching or learning is improved (Jerald, 1998).

Two explanations for this lack of evidence were reported in *Education Week* (Jerald & Orlofsky, 1999). First, educational institutions were spending the bulk of funds, 60%, on hardware and networks. Second, professional development received only 5% of
funding. They also reported that a National Survey of Teachers' Use of Digital Content (computer-based learning resources) showed only 42% of the 1,407 teachers surveyed had more than 5 hours of training in basic technology skills and only 29% of that training focused on curriculum integration. Jerald and Orloffsky and Kent and McNerney (1999) reported that while many teachers still lack the training and confidence to infuse computers into their teaching, others are not using technology to its fullest advantage. Has anyone asked the teachers to explain why?

One reason appears to be barriers. Brickner (1995) categorized previously identified barriers as either extrinsic or intrinsic. Extrinsic, or first-order, barriers as identified by Hadley and Sheingold (1993) are scarce equipment, insufficient training, and limited time. Intrinsic, or second-order, barriers as identified by Hativa and Lesgold (1996) are teachers' preferred instructional methods and their corresponding beliefs about teaching and learning. It is important to note that teachers have little control over extrinsic barriers, whereas they do have control over intrinsic barriers. Ertmer, Addison, Lane, Ross, and Woods (1999) found that although all teachers in their study reported similar extrinsic barriers, it was the interaction of teachers' beliefs (intrinsic barriers) with extrinsic barriers that facilitated or limited teachers' technology use. Ertmer et al. concluded that although it is important to look at teachers' extrinsic barriers, understanding teachers' goals for technology use and their beliefs about teaching and learning are necessary in order to support efforts to initiate and sustain changes required for an innovation to become practice.
In 1998, a series of university extension technology courses was offered to a cohort of junior high school teachers in north Louisiana. With the support of the principal and area technology coordinator, teachers sought on-site, after-school technology training. The teachers had no prior technology training and were ultimately seeking computer literacy certification. After successfully completing the three, 10-week, 3.75 hour per week technology courses, only a few of the teachers were sustaining their technology use in the classroom. The questions remain: why and how?

The present case study may provide some answers to these pervasive, yet elusive, questions. This study investigated two cohorts of teachers from two north Louisiana schools as they initially integrate technology into their classroom instruction. System superintendents, administrators, and a cohort of teachers from these schools supported the use of technology and requested that two, 10-week, 3.75 hour per week university extension technology courses be taught by the researcher. An Introduction to Technology for Teachers (see ITT Syllabus, Appendix A) and Software Applications, Teaching Methods, and Software Development for Teachers (see AMDT Syllabus, Appendix B) were designed with a constructivist approach to integrate technology into elementary and junior high school classrooms through the use of integrated thematic units. A follow-up case study explored changes in teachers' attitudes, skills, behaviors, and perceptions of coursework to learn how they effectively integrate technology. Data described in teacher profiles included demographic and baseline technology-related information, changes in stages of technology concerns and in levels of technology use, perceptions about constructivist coursework and its impact on teachers' instructional practices, and uses of
technology to support classroom instruction. The study encompassed the 1999-2000 academic year.

The background, purpose, statement of the problem, research questions, theoretical framework, justification of the study, limitations, and definition of terms are presented next.

**Background**

With national emphasis and financial support by government and educational institutions on technology as a means to educate students and the need to know how technology impacts teaching and learning, there is a responsibility to consider how teachers themselves view the utilization and integration of technology. Several questions present themselves. Once in place at their school, how are teachers prepared to use technology the first year, the second year, and beyond? What type of technology training are teachers receiving? What are teachers' concerns about technology? Can teachers effectively use technology to enhance course content delivery? Researchers feel that an investigation of teachers' perceptions about teaching and learning with technology and processes undertaken as they use technology in instruction can provide answers to these questions.

The Concerns-Based Adoption Model (Hall, Wallace, & Dossett, 1973) provided the conceptual framework for facilitating change in teachers' use of technology to support instructional practices. One of the strengths of the concerns-based approach was that it emphasized understanding teachers' attitudes, skills, and behaviors so they can be directly related to what teachers perceive they need (Hall & Hord, 1987). Once needs are
identified, interventions can be suggested which facilitate and sustain change of an innovation (Hord, Rutherford, Huling-Austin, & Hall, 1987). Interventions include involving teachers in discussions and decisions about technology, providing clear and accurate information about technology, clarifying steps and components of technology integration, and furnishing opportunities to develop and use technology skills. These interventions also describe a constructivist approach.

Carlin, Ciaccio, Sanders, and Kress (1997) investigated a student-centered approach featuring open-ended, hands-on thematic curriculum activities supported by technology. Writing and data analysis were the tools students used to explore topics and master concepts. A variety of technologies made revision and data analysis easier, gave visual representation of difficult concepts, and provided an optimal setting for research and the establishment of a community of learners. The study concluded that technology alone did not impact teachers or learners. Carlin et al. reported that engaging other teachers and faculty in serious dialog, respecting everyone's expertise, integrating common ideas, and working out the classroom implementation together changed teachers' behavior in instruction and positively impacted students' performance. These ideas encompass the theoretical framework known as constructivism.

Newby, Stepich, Lehman, and Russell (1996) stated that although a recent term, the idea of constructivism is embedded in a multitude of theories in which individuals actively construct knowledge by working to solve realistic problems. Bruner (1960); Brown, Collins, and Duguid (1989); Dewey (1944); Piaget (1954); and Vygotsky (1962), to name a few, provided the underlying theories of this perspective. Jonassen, Peck, and
Wilson (1999) described the constructivist perspective as a change in meaning which has been constructed from experience. Kent and McNerney (1999) asserted that technology is a vehicle for applying engaging, authentic content; therefore, as constructivism accommodates the application of technology, a constructivist approach will provide the theoretical framework for the professional development component of this study.

**Research Purpose, Problem and Questions**

The purpose of this study was to investigate the learning process of teachers as they begin to implement an innovation. Teachers' stages of concern about technology, levels of technology use, perceptions about coursework impact on technology use and integration, and practices and perceptions about teaching and learning with technology were analyzed through triangulation of presurvey, questionnaire, interview, electronic correspondence, computer log, course documentation, descriptors of a constructivist approach, and observation data (see Components and Sequence of Research Design, Appendix C). The study looked for patterns or themes that support the integration of technology into the classroom. The research problem was based on the need to better understand the processes by which teachers come to integrate technology into their instructional practices. Therefore, the following three questions guided the study:

1. How do teachers' stages of concerns about technology change after completing *ITT* and *AMDT*?

2. How do teachers' levels of technology use change after completing *ITT* and *AMDT*?
3. How do teachers integrate technology after completing ITT and AMDT?

Theoretical Framework

Concerns-Based Adoption Model

The first theoretical framework describes the use of the Concerns-Based Adoption Model (Hall et al., 1973) which diagnoses changes that occur during implementation of an innovation. The ideas for the model and instruments developed to analyze change emerged from research and practice initiated in the early 1970s. Observations of innovation implementation led to hypothesized developmental stages and levels that teachers moved through as they became increasingly involved and skilled in using the innovation (see Appendix D).

Seven stages of concern are identified in the model. These stages are (a) 0-Awareness, (b) 1-Informational, (c) 2-Personal, (d) 3-Management, (e) 4-Consequence, (f) 5-Collaboration, and (g) 6-Refocusing. Stages 0, 1, and 2 focus on self concerns. Stage 3 focuses on task concerns, and Stages 4, 5, and 6 focus on impact concerns. To facilitate change, each stage has a set of interventions (Hord et al., 1987). The researcher adapted these interventions to apply to the utilization and integration of technology (see Stages of Concern and Interventions, Appendix E).

Hall, George, and Rutherford (1979) acknowledged that an individual does not have concerns at a single stage but instead a conglomeration of concerns. Although concerns at each stage exist, concerns at one or two stages are relatively intense. According to the model, nonusers of an innovation have intense Stages 0, 1, and 2.
concerns, with low-intensity Stages 4, 5, and 6 concerns. As use of an innovation begins, Stage 3 concerns would become most intense, with Stages 0, 1, and 2 concerns decreasing in intensity and Stages 4, 5, and 6 concerns gradually increasing in intensity. With experience and increased sophistication in use, Stages 4, 5, and 6 concerns become increasingly intense, while Stages 0, 1, 2, and 3 concerns continue to decrease in intensity.

To verify the existence of stages of concern and test some of the hypotheses formulated about change in concerns, formal instrument development procedures were initiated in late 1973 (Hall et al., 1979). Several different formats and methodologies were explored. The first pilot instruments consisted of open-ended questionnaires, likert-type scales, checklists, and interview procedures. By the spring of 1974, two successful methods for assessing concerns had been identified. The first was the Stages of Concern Questionnaire and the second was the Levels of Use Interview.

**Stages of Concern Questionnaire (SoCQ)**

This instrument (Appendix F) was designed and intended only for diagnostic purposes for participants involved in the "adoption" of a process or product innovation (Hall et al., 1979). The SoCQ addresses how teachers perceive an innovation. The questionnaire was developed during the 2.5 years of research related to measuring stages of concern about an innovation and was found to be highly reliable and valid. Initial test-retest stage score correlations of the SoCQ indicated six of the seven stages of concern to be above .58 \( p < .01 \) and through the course of its use, which continues today, is said to be valid. The Stages of Concern Questionnaire was administered during the beginning and
ending of each technology extension course to investigate teachers' change in attitudes and skills regarding technology utilization and integration.

**Levels of Use (LoU) Interview**

The Levels of Use Interview (Appendix G) was developed in such detail that questions can be asked about various independent yet related behaviors that contribute to an individual's overall level of use of an innovation (Loucks, Newlove, & Hall, 1975). The instrument addresses what a teacher is doing or not doing in relation to the innovation. Eight levels of use of an innovation that an individual may demonstrate are (a) 0-Non-Use, (b) I-Orientation, (c) II-Preparation, (d) III-Mechanical Use, (e) IVARoutine, (f) IVB-Refinement, (g) V-Integration, and (h) VI-Renewal (Appendix H). These levels range from a lack of knowing that the innovation exists to an active, highly effective use of the innovation. The recorded interview was administered individually during the beginning and ending of the second technology extension course to support teachers' change in attitudes and skills and to identify levels of technology use.

An analysis of early studies indicated that 60 to 70% of all first-time innovation users were at the Mechanical Level of Use for a period of time (Hall & Loucks, 1977); therefore, the levels of use data can provide a series of benchmarks that indicate the rate at which change is progressing and intervention is needed. The adoption of an innovation is a developmental phenomenon that each user experiences individually. Each level needs to be accepted as a legitimate step in growth toward sophisticated use (Hall, Loucks, Rutherford, & Newlove, 1975).
The change process takes time and timing (Hall & Hord, 1987). Research implies that effective use of an innovation (routine or higher) will require 3 to 5 years under the right conditions and context. The Concerns-Based Adoption Model (C-BAM) provides a set of concepts and tools which can be used to help teachers move through the process of innovation implementation. Hall and Hord asserted that the concerns-based approach can make a difference for teachers and students, the ultimate targets of improvement efforts. Bradshaw (1997b) stated that the model can help principals, teachers, and central office personnel identify teachers' concerns, thereby offering appropriate staff development interventions. In this study, teachers' stages of concern were compared with the hypothesized stages of concern identified in C-BAM. Teachers levels of use were compared with their stages of concern and presurvey technology use data to investigate changes in teachers' attitudes, skills, and behaviors associated with the use of technology. To confirm how teachers use technology, classroom observation logs including video-tape and photographs, coursework documents including computer logs, electronic correspondence including bulletin board responses and e-mail correspondence, and a list of descriptors of a constructivist approach were additional sources of data used in the analysis of changes in teachers' utilization and integration of technology to support classroom instruction.

Constructivist Approach

The second theoretical framework for this study is embedded in the constructivist perspective. Constructivism represents a collection of theories, including (among others) group investigation (Dewey, 1944), social interaction (Vygotsky, 1962), discovery
learning (Bruner, 1961), direct experience (Piaget, 1954), and situated learning (Brown et al., 1989). Duffy, Lowyck, and Jonassen (1993) acknowledged "the common thread among these theories to be the idea that individuals actively construct knowledge by working to solve realistic problems, usually in collaboration with others" (p. 2). The idea of collaboration was strongly influenced by Dewey's belief in the democratic process and education.

Group investigation, as Dewey (1944) called it, organizes students into democratic problem-solving groups to attack academic problems through democratic procedures of scientific methods of inquiry (Joyce & Weil, 1996). Dewey believed that learning is constructed through a social environment where communication provides a common understanding. Dependent on the need for others and the power to learn from experience, the learning process requires thought, invention, and initiative to apply capacities to new aims (Dewey). This reflective thinking process influenced another theorist named Vygotsky (Van der Veer & Valsiner, 1994).

Vygotsky (1978) defined learning as the internalization of dialog. Learning is a reflective thinking process dependent upon transformations of external activity reconstructing to an internal activity, interpersonal processes transforming into intrapersonal processes, and inner speech and thought transforming into developmental events. Vygotsky believed that social construction of meaning through communication is more productive than if learned alone (Van der Veer & Valsiner, 1994). In essence, meaning through dialog, both internally and externally, leads to the learners' understanding. Bruner (1962), in the introduction to Thought and Language, stated that
Vygotsky's mediational point of view transforms meaning from one level to another. Through an inquiry approach, concepts and language give learners the power and strategy to carry out a cognitive activity.

Bruner's (1960) approach to learning is an active process in which learners construct new concepts based upon their current and past knowledge. Learning takes place most notably in problem-solving situations in which the learning environment is personal, internal, and constructed. The learner selects and transforms information, constructs hypotheses, and makes decisions, relying on a cognitive structure to do so (Joyce & Weil, 1996). The learner, whether individually or in a group, engages in dialog that is appropriate to his or her current state of understanding. Much of Bruner's (1962) discovery learning theory is based on the cognitive development and learning processes identified by Piaget.

Piaget (1954) may be best known for his stages of cognitive development. The four stages are (1) Sensorimotor—birth to 2 years, (2) Preoperational—2 years to 7 years, (3) Concrete Operational—7 years to 11 years, and (4) Formal Operations (abstract thinking)—11 years and up. Although every normal child goes through these stages in the same order, there is variation in the ages at which children attain each stage. Piaget found that learners' intellectual growth occurs through the construction of knowledge by the individual through various active experiences. Learners contribute to these experiences by making sense of them—that is, by using their mental schema to interpret them. As learners encounter information that is new or contrary to prior knowledge, they experience a discord that needs to be resolved. The discord is resolved by incorporating information
that is new or contrary to their prior knowledge into their own view. The individual makes adjustments or accommodations, and when successful, internalizes or assimilates the information. Brown et al. (1989) argued that this knowledge is situated, being in part a product of the activity, context, and culture in which it is developed and used.

Situated learning (Brown et al., 1989) refers to situations that co-produce knowledge through authentic activity. Authentic activities are "the ordinary practices of the culture" (p. 34). The authors argued that the activity, concept, and culture are interdependent; therefore, when learners have access to authentic activities, they can experience learning in a real-life context; and their teachers can act meaningfully and purposefully. This type of situated learning and teaching describes a constructivist perspective.

According to the constructive perspective, learning is determined by the complex interplay among students' existing knowledge, the social context, and the problem to be solved. Thus, instruction provides students with a collaborative environment in which they have the means and opportunity to construct "new and situationally-specific understandings by assembling prior knowledge from diverse sources" (Ertmer & Newby, 1993, p. 63). This perspective characterizes the setting for the coursework component of this study in which teachers learned basic computer operations/concepts and applied them for their own professional growth, productivity, and instructional practices. In this study, descriptors of a constructivist approach, adapted from a study conducted by Beller (1998), were used to identify teachers' descriptions of a constructivist approach.
Justification of the Study

The present case study investigated the learning process of teachers as they begin to implement an innovation (i.e. the integration of technology) and was based on the need to understand better the processes by which teachers come to incorporate technology into their instructional practices. An understanding of teachers’ interests in learning technology, their beliefs and values about technology, their interactions with other teachers and administrators, and their levels of technology use is needed in order to learn effective application strategies to facilitate and sustain technology usage. This process involves investigating each teacher’s aspect of disequilibrium, accommodation, and assimilation which can only be described through the use of qualitative methods. Data derived from descriptive statistics (how a particular characteristic is distributed among a group) or inferential statistics (how likely it is that the results of the study can be generalized) were not of interest or concern to the researcher’s present study (Crowl, 1996). The case studies of 12 teachers were constructed from data collected in questionnaires, interviews, electronic bulletin boards, observations including video-tape and photographs, and coursework documentation in the field to learn how, if, and why each teacher learns, applies, and supports instruction with technology during the first year of innovation, and whether the constructivist approach used within coursework impacts implementation.

There is no dispute that technology plays, and will continue to play, an important role in society. Billions of dollars are being spent to put technology into schools, but is technology improving teaching and learning? Jerald (1998) reported that...
on technology and student achievement was inconclusive and that there was a lack of sufficient descriptive data about technology use in education. Cuban, (Trotter, 1998) an education professor at Stanford University and longtime investigator of the use of educational technology, explained that inconclusive evidence exists because “educators need to agree on, and clarify, their goals for using technology, or they have no business looking to research for answers” (p. 8). Because researchers agree that teachers are the link between technology and instructional usage, this study searched for insights about this link.

The Milken Exchange conducted the Education Technology’s 1999 Survey of Technology in the Schools from October 1998 through June 1999 to evaluate three areas of concern: access to technology, capacity to use technology, and use of technology. Milken received approximately 4,000 responses. In a summary of the report, Jerald and Orlofsky (1999) reported that schools often rely on out-of-date and inequitably distributed technology, and that teachers lack training and confidence to integrate technology and are not using technology to the fullest advantage. In the present study, these universal areas of concern were addressed in teacher profiles.

Ertmer et al. (1999) stated “that missing from the literature is a description of what the integration process is like for teachers who have limited resources—that is, those who experience a greater number of first-order barriers” (p. 56). Teachers in the present study were characterized as having limited resources of equipment, software, and time. This study provided data on how teachers with limited resources initially integrate technology.
The case study approach utilized in this study chronicles each teacher's movement through a cycle in which he or she was analyzing his or her present knowledge of technology, adjusting his or her attitude and skill toward technology, and practicing classroom instruction supported by technology. Teachers were exposed to a variety of technology tools such as word processing, spreadsheets, databases, multimedia presentations, educational software, electronic mail and bulletin or message boards, and Internet. Teachers discussed, shared, applied, and delivered applications based on their own needs.

**Limitations**

Teachers had limited access, capacity, and use of technology during the investigation of the study. Access to technology was needed in and out of the classroom. Each teacher's capacity determined the amount of time and access needed to use technology in and out of the classroom. Teachers' use of technology was determined by their own individual teaching practice and need.

Research has shown that it takes many years to become a technology-using teacher; the present study occurred during 1 academic year. Even though the length of the study was brief, the purpose of this study was to investigate the learning process of teachers as they begin to implement an innovation. The research problem was based on the need to understand better the processes by which teachers come to integrate technology into their instructional practices.

The influence of the researcher's role as instructor and change facilitator may have had an impact on teacher's utilization and integration of technology to support his or her
classroom instruction. As an instructor, the researcher's role was to model a constructivist approach to learning and teaching. As a change facilitator, the researcher's role was to facilitate and sustain the utilization and integration of technology to support classroom instruction. Although, these roles may be perceived as a limitation, educators can use the findings in this study to develop and design professional development sessions.

Teachers volunteered to participate in the study to provide evidence of technology's impact on teaching and learning. Course requirements were the same for all teachers, nonparticipants and participants of the study. The SoCQ was administered to all teachers, nonparticipants and participants. However, Levels of Use Interviews, computer logs, and classroom observations were only conducted for teachers participating in the study. These strategies may have had an additional impact on teachers utilization and integration of technology to support classroom instruction. Although, these strategies may be perceived as a limitation, educators can use the findings in this study to provide and participate in professional development sessions.

Teachers learning to incorporate technology into their instructional practices took place within a situated environment. According to Stake (1994), "The case is a functioning specific" (p. 236), meaning that it is an integrated system with boundaries and behaviors specific to the case. Stake explained that "Case studies are of value in refining theory and suggesting complexities for further investigation, as well as helping to establish the limits of generalizability" (p. 245). He further justified that a case study is both the process of learning about the case and the product of learning, acknowledging that not everything about the case can or needs to be understood. Triangulation (Denzin, 1989) assisted in
reducing the likelihood of misinterpretation and in reporting the case in sufficient detail to allow the reader to make good comparisons with other cases.

**Definition of Terms**

1. **Access 97** is a database program used to organize and sort information (Blanc & Vento, 1997, p. vi).

2. **Bulletin Board** is a computer service designed as a public forum, allowing individuals to post messages for others to read (Newby et al., 1996).

3. **Concerns-Based Adoption Model** is a model developed at the Texas R&D Center to conceptualize and facilitate educational change (Hall et al., 1979).

4. **Constructivism** refers to the building of knowledge which results from an activity that is processed by an individual and cannot be transmitted passively to another individual (Sparks, 1994).

5. **Excel 97** is a spreadsheet program used to analyze and graph numerical data (Blanc & Vento, 1997, p. vi).

6. **HyperStudio** is an interactive multimedia and hypermedia authoring software. Interactive multimedia refers to multimedia which allows user interactions so that the user can determine the direction of the program or presentation. Hypermedia extends the notion of hypertext to other media besides text. In a hypermedia system, nodes of information may contain graphics, animation, video, and audio, as well as text. An authoring system is a program that permits the development of interactive computer-based applications without needing programming knowledge (Newby et al., 1996).
7. **Impact** refers to changes in attitudes, behaviors, and practices as the result of innovation implementation.

8. **Implementation** refers to the actual use of the integration of technology.

9. **Innovation** or **Process Being Implemented** refers to teachers' initial integration of technology.

10. **Integrate Technology, Integration of Technology, or Technology Integration** refers to the use of technology to directly support curriculum and instruction (International Society for Technology in Education, Standard 1.3).

11. **Integrated Software** refers to multiple applications included in one package that can be used separately or together (Blanc & Vento, 1997, p. vi). In this case study, the package—Microsoft Office 97 Professional—includes Word, Excel, Access, and PowerPoint.

12. **Levels of Use of the Innovation** is a concept described in the Concerns-Based Adoption Model (Hall et al., 1973). Eight levels of use of an innovation that an individual may demonstrate (see Appendix H) range from lack of knowing that the innovation exists to an active, sophisticated, and highly effective use of it and, further, to active searching for a superseding innovation (Loucks et al., 1975).

13. **PowerPoint 97** is a presentation software designed for the production and display of computer text and images, intended to replace the functions typically associated with the slide projector and overhead projector (Newby et al., 1996).

14. **Stage of Concern** means a relative indicator of an individual’s attitude and skill toward an aspect of an innovation.
15. **Technology or Technology Utilization** refers to participants' personal and professional use of the computer and its tools. Tools are Internet and software applications to support classroom instruction.

16. **Word 97** is a word-processing program used to create and edit documents (Blanc & Vento, 97, p. vi).

**Summary**

Little research exists that provides conclusive evidence that technology use improves teaching or learning. Explanations offered for the inconclusive evidence are insufficient training of teachers in the effective use of technology, lack of clear goals for using technology, and limited descriptive reports of how technology impacts teachers and learners. Researchers feel that an investigation of teachers learning and teaching with technology would assist in providing evidence of technology’s effect.

The research problem was based on the need to understand better the processes by which teachers come to integrate technology into their instructional practices. Piaget (1954) found learners' intellectual growth occurs through the construction of knowledge by the individual through various active experiences. As learners encounter information that is new or contrary to prior knowledge, they experience a discord that needs to be resolved. The discord is resolved by incorporating information that is new or contrary to their prior knowledge into their own view. The individual makes adjustments or accommodations, and when successful, internalizes or assimilates the information.

This study focused on teachers' change in attitudes, behaviors, and instructional practices as they learn and apply technology after receiving training. Two, 10-week, 3.75
hour per week university technology courses designed with a constructivist approach were
delivered to two cohorts of teachers and described in individual teacher profiles or cases.
The Concerns-Based Adoption Model was used to diagnose and measure change. The
following chapter includes a literature review on the factors affecting teachers’ use of
technology, professional development as a change agent, phases of the change process,
the concerns-based approach, the role of constructivism in the change process, a
constructivist approach to professional development, constructs and features that shape
qualitative research, and strengths of case study research.
CHAPTER 2

REVIEW OF THE LITERATURE

Technology is increasingly seen as a learning tool that places great demands on teachers to use technology to support instruction. These demands compound an already laden agenda for teachers with limited time and resources; however, some teachers are using technology despite a multitude of barriers. These teachers need to be studied to learn how they effectively utilize and integrate technology.

Teachers' acceptance, training, and utilization of technology are the only assurances that technology will support instructional practices (Carlin et al., 1997; Charp, 1997; Kent & McNergney, 1999). Current demand for technology implementation requires changes in teachers' instructional practices, but change is not easy. Cuban said a uniform framework to achieve the goals of technology—improving student's learning and enhancing teacher's efforts—could facilitate the process (Trotter, 1998). However, unless teachers' attitudes, skills, and behaviors about technology are known, a framework to achieve these goals will be unlikely.

Using the Concerns-Based Adoption Model to identify teachers' technology concerns and levels of use is a first step. The second step is to provide teachers with professional development that supports instructional practices. This chapter includes a
review of literature appropriate for this study. Six areas guided the study: technology and teachers, change, constructivism, professional development, qualitative research, and case study research.

**Factors Affecting Teachers' Use of Technology**

In a study conducted by O'Donnell (1996) on the integration of computers in the classroom, results indicated that the majority of teachers failed to utilize computers in direct classroom instruction. O'Donnell found that teachers did not understand how to use computers in the teaching process, how to utilize software, or how to redesign their instruction to incorporate computers in the classroom. Suggestions from the study included the need to know teachers' perceptions of their computer skills and the extent of their desire to receive further training. O'Donnell stressed that professional development programs must address the specific needs of teachers and should be ongoing over an extended period of time.

Meltzer and Sherman (1997), like O'Donnell (1996), believed that technology implementation must target the needs of teachers. They insisted that professional development must be ongoing and periodically assessed for participants' progress and emerging needs. Needs included identifying obstacles, because without this knowledge, there will be little impact of technology utilization by teachers.

Marsh (1999) asserted that teachers must move beyond excuses such as "I haven't been trained," "I don't have the time," and "I'm no good with computers" because much of the learning about technology has to be self-taught. Teachers must learn through experimenting, reading, attending computer education meetings, and interacting with other
teachers involved with computers. Learning takes time and needs to be ongoing, but teachers must "just do it" (Mergendoller, 1997; Marsh, 1999); therefore, the amount and placement of technology, capacity, and maintenance of equipment are essential for technology use (Meltzer & Sherman, 1997; Bradshaw, 1997b).

Cawelti (1993b) acknowledged that the impact of technology on society has dramatically altered the classroom, necessitating different skills and qualifications for teachers. While statistics have shown that schools in the United States have access to technology, specifically computers, teachers are not adequately trained to use technology or to incorporate technology into classroom practices (Jerald & Orlofsky, 1999; Kent & McNerney, 1999).

According to a report by the Office of Technology Assessment (1995), technology training has been fragmented and unrelated to content, and teachers have lacked ongoing support. In addition, the opportunity for teachers' learning does not appear to mirror what everyone expects for students, i.e. engaging students in experiencing, creating, and solving real problems, using their own experiences, and working with others (Lieberman, 1995). Finally, Moersch (1995) noted that most professional development opportunities incorrectly assume that teachers will make connections between the technology and their instructional curricula and that teachers will be ready and willing to change their instructional practices.

Researchers (Bradshaw, 1997b; Meltzer & Sherman, 1997) acknowledged that the lack of time—for training, for trying out technology in the classroom, and for talking to other teachers about technology—is a major barrier to classroom implementation.
Bradshaw (1997b) and O'Donnell (1996) have reported fear, insufficient access, and lack of support as reasons for teachers' non use of technology. Cuban (1995b) offered the following explanations as to why teachers use technologies infrequently and selectively:

1. Limited access to equipment that quickly becomes obsolete.
2. Limited time to use technology due to class schedules.
3. Teacher's beliefs about instruction and learning, knowledge about new technologies, and prior attitudes toward technology determine whether and how students will get to use computers.

Cuban offered these explanations to acknowledge that those who believe technology will make a difference will have to be very patient.

Charp (1996) agreed that technology integration is a slow and gradual process due to a number of factors, including faculty indifference, lack of training, lack of administrative support, lack of proper infrastructure to encourage use of technology, lack of a strategic plan to follow, and lack of funds. She further found that teachers need computers and peripherals, software knowledge, software availability that meet learning objectives, confidence and skill in handling computers and software, and time to learn and use computers and software for teaching practices.

**Professional Development as a Change Agent**

Professional development has been the predominant method used to introduce innovations to teachers in educational settings. To be successful, Chance (1999) believed that the innovation needs to be relevant, beneficial, and similar to the teacher's personal views. For technology innovation, teachers must weigh the benefits of technology use on
how simple the technology is to learn, how much time and energy is needed to invest in learning it, and the degree of its reliability (Cuban, 1995a).

A shared vision for technology use in the schools and an evolving long-range plan were found to be two effective strategies for teachers to incorporate technology into their classrooms (Bradshaw, 1997b). Bradshaw found teachers who were actively involved in planning and implementing their own professional development demonstrated a more receptive attitude toward implementation than teachers who were not actively involved in the process (Sparks & Loucks-Horsley, 1990). "When professional development efforts include a presentation of theory and information, demonstration, practice with feedback, and coaching with follow-up over time, the transfer to the classroom and the return on the investment in instructional improvement are significantly increased" (Bradshaw, 1997b, p. 88). In this way, teachers are challenged to become change agents by creating conditions to use and develop technology as a resource for teaching. Teachers and their usage of technology to support new teaching strategies are inseparable, essential components contributing to innovation.

As stated, professional development has been used to introduce new methodology and content to in-service teachers for over 30 years. This approach is intended to satisfy and meet the needs of all participants. Sparks (1994), author of numerous articles on professional development, stated that school in-service training was created to help stimulate change within the teachers. In-service programs have traditionally been presented by experts who tell teachers how to perform or how to present new material. Matthews (1994) contended that teachers have been brought in for professional
development, told what change they must implement in their classrooms, and given a short time to practice the innovation. The delivery of one-shot, show-and-tell professional development has been the norm in which teachers have been asked to make changes without regard for their individual needs, attitudes, skill, resources, or strategies to implement the proposed changes. Teachers have to attach personal meaning to new experiences before they can accept what the changes mean for their own instructional practices, the teaching profession, and student learning (National Staff Development Council, 1995). In contrast, personal meaning and understanding about change has been found to enable teachers to implement new ideas with confidence and leads to autonomy.

According to Castle and Aichele (1994), autonomy has been found to be a key element in effective professional development. Autonomy for teachers means making choices and decisions, setting goals, reflecting on teaching practices, exchanging points of view with colleagues, and engaging in dialogs with peers on relevant educational issues. Teachers who were found to be in control of their own learning, including the selection of goals and means of assessment, were more likely to see connections and engage in practices that reflected a cohesive view of the relationship of teaching and learning. Castle and Aichele suggested that autonomy leads to continued construction and reconstruction of knowledge, progress in the field, and ultimately, change in classroom practices.

One purpose of professional development is to provide teachers with the knowledge and skills that enable them to implement new curricula. Programs often focus on training teachers to use resources and activities associated with new curricula but do
little to include teacher contributions to the content and format of these programs. Professional development is clearly essential (Meltzer & Sherman, 1997; Mergendoller, 1997), "but it does not exist in a vacuum" (Bradshaw, 1997b, p. 86). Bradshaw contended that necessary steps included visualizing, planning, and financing. In addition, Loucks-Horsley (1997) suggested that professional development be based on what is known about adult learning and the process of innovation, teachers must be involved in planning and implementing professional development activities. Darling-Hammond and McLaughlin (1995) found that teachers were motivated for professional development by career advancement opportunities, pay increases, and personal satisfaction. Knowledge, skills, attitudes, and behaviors of teachers were also essential in planning effective professional development.

Professional development has been the means by which new content and methodology were presented to teachers for implementation in their classrooms (Beller, 1998). Innovative ideas and practices are presented at conferences and conventions by researchers, and teachers are left with the option to use the presented ideas in their classrooms or file the ideas away for future reference. Either way, Beller noted that this form of professional development was ineffective and had little impact on classroom practice.

According to Sparks (1994), professional development with established standards and good implementation models is becoming widely available. However, Loucks-Horsley (1997) suggested that professional development still has a long way to go before the classroom practices of teachers mirror outcomes desired for students. Identifying
professional development goals has been found to be imperative to the success of professional development efforts. Teachers need to know the level of importance, the expected goals, and the rationale for recommended changes in order to accept the change being suggested (NSDC, 1995).

Professional development is a process, like change, which impacts teachers' classroom practices (Hall & Hord, 1987). Recognizing the link between professional development and successful educational change, Lieberman, Darling-Hammond, and McLaughlin are among the leading school reformers who have called for a new approach to professional development (Sparks & Hirsch, 1997). Lieberman (1995) recognized that while everyone appeared to want a wide array of learning opportunities for students which would engage them in experiencing, creating, and solving real problems, they were somehow absent when teachers reversed roles and became learners. She noted the following similarities between the ways students learn and teachers learn:

People learn best through active involvement and through thinking about and becoming articulate about what they have learned. Processes, practices, and policies built on this view of learning are at the heart of a more expanded view of teacher development that encourages teachers to involve themselves as learners in much the same way they wish their students would. (p. 592)

Success in any improvement effort hinges on the smallest unit of the organization and, in education, that is the classroom teacher (McLaughlin, 1992). Teachers are the individuals chiefly responsible for implementing change. Therefore, professional development, regardless of form, must be relevant to teachers and must directly address specific needs and concerns (Hall & Loucks, 1977; Sparks & Loucks-Horsley, 1990). In professional development from a constructivist perspective, "teachers and administrators
will collaborate with peers, researchers, and their own students to make sense of the teaching/learning process in their own contexts” (Sparks, 1994, p. 27).

Phases of the Change Process

The change process, according to Fullan (1991), was found to involve three phases: initiation, implementation, and institutionalization. Individuals had different needs during each phase and progressed through phases at different rates. The time frame from initiation to institutionalization for moderately complex changes was 3 to 5 years.

In another study supporting the change process over time and through phases, the Apple Classrooms of Tomorrow (ACOT) labeled the stages of evolution in its classroom as entry, adoption, adaptation, appropriation, and invention (Dwyer, Ringstaff, Haymore, & Sandholtz, 1990). The ACOT longitudinal study began in 1986 and examined what happened to teachers and students when they had unlimited access to technology. The study demonstrated that the introduction of technology to classrooms could significantly increase the potential for learning, especially when it was used to support collaboration, information access, and the expression and representation of students' thoughts and ideas. However, it did not occur overnight.

During the first 4 years of the study, 32 teachers in four elementary schools and one high school were encouraged to implement constructivist approaches to learning in their classrooms. Teachers' beliefs about schooling based on lecture, recitation, and seatwork persisted, despite the best efforts of activists for school reform. Consequently, teachers experienced intense inner conflicts as they explored alternative approaches that sharply contrasted their beliefs, and students learning tasks remained unchanged. As
teachers moved through these stages, however, traditional methods were strengthened by technology and then were gradually replaced by more active and engaging learning experiences.

Initially, teachers in the ACOT study struggled as they spent most of their time establishing order and learning to use the equipment. This phase was followed by a period in which teachers used the technology to support familiar methods and materials. During adaptation, teachers discovered that they could cover the standard curriculum in less time with technology, leaving more time for higher-order learning and problem solving. In the second year, when teachers understood technology well enough, they began to use technology naturally as a tool. ACOT teachers never reached the final stage, invention, during the 4-year period.

Results supported what other researchers had previously reported—change is difficult. Teachers have to change long-held beliefs. Although every ACOT teacher and student had access to computers, access was not enough to change teachers' practices. Technical training for teachers was found to be vital in the beginning, but it was the ongoing support, opportunities to examine and discuss their actions and beliefs, and freedom to explore new approaches and curricula that facilitated changes in teachers' classrooms. In retrospect, the essential contribution of the ACOT study was in creating professional development for teachers where technologies were used to support collaboration, communication, inquiry, and knowledge construction.

Fifteen years after results of the ACOT study were released, teachers are still struggling to integrate technology. It would appear that administrators have learned little
from the ACOT study, ignoring teachers' concerns, and providing little, if any, technology training. However, as administrators and teachers are required to show evidence of technology's impact on teaching and learning, the ACOT study has important implications. Teacher attitudes, skills, and behaviors must be acknowledged and infused into a professional development program that will facilitate and sustain innovation implementation.

Becker (1994), an education professor at the University of California, Irvine, surveyed 726 computer using teachers at 153 schools participating in the National School Network, a research project started by education technology enthusiasts and sponsored by the National Science Foundation. Most of the 441 respondents said that over the past several years, their teaching style had changed in ways that he described as constructivist. Teachers were moving toward teaching longer projects, giving students more chances for active, out-of-seat work, using more interdisciplinary content, giving students more opportunity to review and revise their work, having students work more in cooperative groups, and being more reflective teaching goals. Although they were changing their teaching style, teachers must want to teach this way and believe that it is legitimate. Becker's findings parallel those of the ACOT study. Teachers initially used technology to strengthen a curricula taught in a lecture-recitation-seatwork mode. They gradually changed their patterns of teaching to include more dynamic learning experiences for students.

In order to identify teacher attitudes, skills, and behaviors associated with technology, Hall and Hord (1987), long-time researchers of the change process, advocated...
the use of a concerns-based approach to innovation implementation that utilizes research-based tools, techniques, and approaches to identify an individual's concern and level of use of the innovation. Once identified, teachers concerns and levels of use must be acknowledged and infused into a professional development program to facilitate and sustain innovation implementation.

The Concerns-Based Approach

The Concerns-Based Adoption Model, C-BAM, (Hall et al., 1973) emerged from research and practice in the 1970s. When observing the experiences of teachers as they adopted and implemented educational innovations, developers of the model became aware that a process was involved, resulting in the following developmental stages: (a) 0-Awareness, (b) 1-Informational, (c) 2-Personal, (d) 3-Management, (e) 4-Consequence, (f) 5-Collaboration, and (g) 6-Refocusing (see Appendix E).

Several assumptions and assertions underlie the concerns-based adoption approach. First, understanding the point of view of the participants in the change process is critical. Second, change is a process, not an event. Third, progression through stages can be facilitated but not forced. Finally, concerns do not exist in a vacuum. Teachers are influenced by feelings about the innovation, perceptions of their own ability, and other changes occurring simultaneously. Additionally, they are influenced by the setting in which change occurs and the support they are provided. These assumptions and assertions are parameters that guide the concerns-based approach and provide a research-verified way to think about, plan for, monitor, and facilitate change (Hall & Hord, 1987).
In the C-BAM model, the change facilitator investigates participants as they undergo change, identifies concerns, and applies interventions, thus facilitating the Levels of Use of an innovation: (a) 0-Non-Use, (b) I-Orientation, (c) II-Preparation, (d) III-Mechanical, (e) IVA-Routine, (f) IVB-Refinement, (g) V-Integration, and (h) VI-Renewal (see in Appendix H). Interventions are an important responsibility for the facilitator, as they are the key to moving toward more sophisticated use of an innovation and change (Hall & Hord, 1987). Typically, individuals have intense informational and personal concerns that can be addressed by providing a general overview of the innovation, plans for change, and appropriate training. Individuals need to know what is expected of them, how long it may take to accomplish anticipated tasks, and who is available to provide support. As use of the innovation increases, higher management concerns can be addressed by providing additional training, coaching, and consultation.

The Stages of Concern Questionnaire (see in Appendix F) can be used once or twice a year to chart the progress of an individual and provide appropriate intervention. The Levels of Use (see in Appendix G), a second diagnostic tool, can also be used once or twice a year to provide ways to understand and describe implementation at the classroom level. Levels of Use can provide benchmarks for individuals to achieve and, like the developmental stages of concern, require timely, specific interventions. Hall and Hord (1987) report that it takes 3 to 5 years to implement new or innovative programs.

**The Role of Constructivism in the Change Process**

The term "constructivism" means different things to different people. Matthews (1994) stated that two major traditions were (a) psychological (radical) constructivism...
which arose from Piaget's accounts of his children and (b) social constructivism from Vygotsky who stressed the "importance of language communities for the cognitive constructions of individuals" (p. 138). Constructivism, a relatively new term for a combination of theories and methodologies, is not a new practice.

In the first part of last century, Dewey's (1944) educational philosophy and practice contained the thought that curriculum should relate instruction to children's experiences and needs. Constructivism is the process each person uses to assimilate his or her own meaning to present experiences and applies to prior knowledge and understanding. The term constructivism grew out of the idea that learners construct or build their own individual learning and process this information in their brain as a cognitive process.

When educators attend workshops, seminars, and required school in-service programs, they become the learner. Constructivism is a way of knowing and learning which can be applied to students, teachers, and administrators. In promoting learning, constructivism has been found to tap into unique learning styles and stimulate the learning process (Beller, 1998). Learners construct knowledge as a result of thought and action. Because knowledge is constructed, learners bring their own experiences to the classroom where prior experiences impact their own learning. Knowledge exists within students and is developed as they interact in social situations with teachers and peers and within the classroom environment. As students interact with others and with classroom materials, they develop their own understandings by fitting new ideas into their existing views (Yager, 1991).
Constructivist views about learning have gained acceptance among educators as a viable framework for understanding learning and for developing models of effective teaching (Beller, 1998). Constructivism is included in many of the curriculum standards as an integral component of recent educational reform. In the constructivist approach, each individual defines knowledge in relation to his or her experiences, both in isolation and in social settings. Knowledge is viewed as the result of some activity that is processed by the individual and, therefore, cannot be transferred passively from one individual to another (Brooks & Brooks, 1999). Constructivism recognizes that everyone carries a series of explanations in his or her mind.

Constructivism is composed of an individual’s prior constructs and is used as the basis for understanding the environment (Beller, 1998). According to Beller, the widespread acceptance of this theory as a model of learning requires some meaningful changes in the design of professional development for teachers. These should include meaningful activities, opportunities for problem solving, and time to reflect on what has been learned.

**A Constructivist Approach to Professional Development**

While many teachers support the constructivist goals of active, engaging learning and understanding, they do not find it easy to become a constructivist teacher (Brooks & Brooks, 1999). According to Brooks and Brooks, “unless teachers are given ample opportunities to learn in constructivist settings and construct for themselves educational visions through which they can reflect on educational practices, the instructional programs they learn will be trivialized into ‘cookbook’ procedures” (pp. 121-122). Yager (1991)
described a constructivist approach to in-service which included the following components: teachers actively planning program objectives; teachers learning through demonstrations, trials, feedback, and give-and-take; teachers and leaders sharing and providing mutual assistance; and program goals that directly link to goals of the school. Sparks (1994) contended that constructivist teaching was best learned through constructivist professional development and suggested that peer collaboration and activities involving action research, conversations with peers about beliefs and assumptions that guide their instruction, and reflective practices such as journal keeping should be a part of a constructivist professional development program.

The constructivist components described by Sparks and Yager are closely aligned with the Principles of Effective Professional Development for Mathematics and Science Education: A Synthesis of Standards in the National Institute for Science Education as described by Loucks-Horsley, Stiles, and Hewson (1996). They described effective professional development as the following:

- Being driven by a clear, well-defined image of effective classroom learning and teaching.

- Providing teachers with opportunities to develop knowledge and skills and to broaden their teaching approaches so they can create better learning opportunities for students.

- Using instructional methods to promote learning for adults which mirror the methods to be used with students.
- Building or strengthening the learning community of science and mathematics teachers.

- Preparing and supporting teachers to serve in leadership roles if they are inclined to do so.

- Providing links to other parts of the educational system.

- Including continuous assessment.

Clearly, standards embedded in a constructivist approach must be incorporated and modeled in the professional development of teachers. However, the needs and concerns of individual teachers must be carefully considered and set to work before constructivist practices and learning can be evidenced in the classroom.

**Constructs and Features that Shape Qualitative Research**

Researchers using a qualitative design face many challenges. Marshall and Rossman (1999) described three challenges to those proposing qualitative study: (a) developing a conceptual framework that is thorough, concise, and elegant; (b) planning a design that is systematic and manageable, yet flexible; and (c) integrating these functions into a document which convinces readers that it should be done, can be done, and will be done. Qualitative researchers must present data that are sound, useful, and sensitive to bias.

Lincoln and Guba (1985) proposed four constructs for judging soundness, usefulness, and bias. The first, *credibility*, demonstrates that the inquiry is conducted in a manner that ensures the subject is accurately identified and described. The subject is said to be valid when it includes an in-depth description of the setting, group of individuals,
and theoretical framework of the study. The second construct, *transferability*, refers to the usefulness of the study. The external validity of the study can be achieved when the researcher ties data collection and analysis to the theoretical framework of the study. The triangulation (Denzin, 1989) of data or the use of multiple sources of data to support each point within the study serves to strengthen the study’s usefulness for other settings.

*Dependability*, the third construct, accounts for the changing conditions of what is being studied and what is being learned from the study. As the researcher attempts to understand the phenomena of the study, he or she acknowledges that the inquiry takes place in an evolving social system. The final construct, *confirmability*, means that the data should confirm the general findings of the study and lead to implications, not the researcher’s evaluation. These constructs provide the rationale for defending qualitative research; however, the characteristics of qualitative research are equally important.

Bogdan and Biklen (1992) described five features that shape qualitative research. First, qualitative research has the natural setting as the direct source of data and the researcher as the key instrument. Qualitative researchers are concerned with understanding the context in which research occurs. Second, the data collected are descriptive. Interview tapes, observations, field notes, photographs, and documents are used by the researcher to search for details that can be portrayed by the written word, providing a better understanding of the phenomena under study. Third, qualitative researchers are concerned with process rather than outcomes. They want to know “how” and “why” events occur where the investigator has little control (Yin, 1994). Fourth, data are analyzed inductively meaning hypotheses are not approved or disproved, but issues emerge from the study.
Researchers construct a picture as data is collected and analyzed. Finally, the meaning or perspectives of participants are of essential concern. Participants interact with researchers and researchers interact with participants, each learning from the other. These features are most often described in the form of a case study.

**Strengths of Case Study Research**

Case study is a basic design that can accommodate a variety of disciplinary perspectives, as well as philosophical perspectives. It can test theory or build theory, incorporate random or purposive sampling, and include quantitative and qualitative data (Merriam, 1988). Case study is an ideal design for understanding and interpreting observations of educational phenomena. The purpose of most descriptive research is limited to the setting in which it occurs; however, some descriptive research suggests causal relationships and, as Lincoln and Guba (1985) contended, is transferable. Descriptive case studies are usually unique, inductive, and narrative by nature.

The uniqueness of case study lies in the questions asked and the patterns of unanticipated as well as expected relationships (Stake, 1995). Stake maintained that knowledge learned from case study is different from other research knowledge because it is more concrete, contextual, and constructed. Personal experience makes the case more vivid, concrete, and sensory. This strength can also lead to better understanding that, in turn, can affect and perhaps even improve educational practices (Merriam, 1988). Yin (1994) said that case study is preferred in examining contemporary events in which behaviors cannot be manipulated.
Although descriptive, case study can be extremely time consuming and financially burdensome. Overcoming this first hurdle, the results and conclusion of case study may be deemed too lengthy, too detailed, or too involved to read and use (Merriam, 1988). Guba and Lincoln (1985) also warned that case studies are not accounts of the whole picture and can lead readers to inaccurate conclusions. The sensitivity and integrity of the investigator also limits case studies, and Yin (1994) asserted that this is perhaps the greatest concern for those who oppose case study strategies.

Yet, as Stake (1995) explained succinctly, “There are times when all researchers are going to be interpretive, holistic, naturalistic, and uninterested in cause, and then, by definition, they will be qualitative inquirers” (p. 46). Qualitative case study is highly personal research. The quality and utility of case research is not based on reproducibility, but on the meanings generated and whether or not they are valued by the reader (Stake, 1995).

**Summary**

If evidence is needed to document the improvement of teaching and learning through the use of technology, researchers must first realize that it will involve teachers’ acceptance, training, and utilization of technology. Meltzer and Sherman (1997) believed that technology implementation must target the needs of teachers. Teachers need time for training, for trying out technology in the classroom, and for talking to other teachers about technology (Bradshaw, 1997b; Meltzer & Sherman, 1997). They also need access and support. O’Donnell (1996) found that teachers do not understand how to use computers in the teaching process, how to utilize software, or how to redesign their instruction to
incorporate computers in the classroom. Additionally, Marsh (1999) found that everyone involved in the process needs to know that technology implementation takes time and needs to be ongoing.

Therefore, in order for professional development to be successful, it must be relevant, beneficial, and similar to the teacher's personal views (Chance, 1999). A shared vision for technology use in the schools and an evolving long-range plan were found to be two effective strategies for teachers to incorporate technology into their classrooms (Bradshaw, 1997b). In this way, teachers are challenged to become change agents.

Professional development is a process, like change, which impacts teachers' classroom practices (Hall & Hord, 1987). Recognizing the link between professional development and successful educational change, Lieberman, Darling-Hammond, and McLaughlin are among the leading school reformers who have called for a new approach to professional development (Sparks & Hirsch, 1997). In professional development designed with a constructivist perspective, "teachers and administrators will collaborate with peers, researchers, and their own students to make sense of the teaching/learning process in their own contexts" (Sparks, 1994, p. 27).

In two studies, by Dwyer et al.(1990) and Becker (1994), results supported what other researchers had previously reported-change is difficult. Access was not enough to change teachers' practices; teachers had to change long-held beliefs. Technical training for teachers was found to be vital in the beginning, but it was the ongoing support, opportunities to examine and discuss their actions and beliefs, and freedom to explore new approaches and curricula that facilitated changes in teachers' classrooms.
Years later, teachers are still struggling to integrate technology. The Concerns-Based Adoption Model provides a way to identify teachers' concerns and levels of use and to apply interventions that facilitate and sustain change. However, as research has shown, learning needs to be an active process (Leiberman, 1995). Constructivism, the process each person uses to assimilate his or her own meaning to present experiences and apply to prior knowledge and understanding (Dewey, 1944), would meet these needs. Professional development designed with a constructivist approach would provide teachers with experiences needed to learn and teach with this approach (Sparks, 1994).

In order to learn how teachers are changing their attitudes, skills, behaviors, how they effectively integrate technology to support instruction, and how they perceive coursework designed with a constructivist approach, this study required the use of qualitative research. This study used four constructs—credibility, transferability, dependability, and confirmability (Lincoln & Guba, 1985) to judge soundness, usefulness, and bias. This researcher collected descriptive data in a natural setting to learn teachers' process of change. A picture was constructed in the form of teacher profiles as data were collected and analyzed. Data analysis also revealed emerging issues. These are the features that shape qualitative research (Bogdan & Biklen, 1992) and are most often described in the form of a case study.

Case studies can include quantitative and qualitative data (Merriam, 1998). The uniqueness lies in the questions asked and the patterns of unanticipated, as well as expected, relationships (Stake, 1995). Stake maintained that knowledge learned from case study is more concrete, contextual, and constructed. Merriam (1988) contended that the
researcher's personal involvement makes the case more vivid and sensory, leading to better understanding. This strength, in turn, can affect and even improve educational practices.

Data collection, research design, participant selection, course, and setting of the present case study are described in the next chapter.
CHAPTER 3

METHODOLOGY

Purpose

School system superintendents, administrators, and a cohort of teachers from two northern Louisiana schools supported the use of technology integration. Although the majority of teachers from these schools, even though they appeared to support it, were not integrating technology. Therefore, two courses, an Introduction to Technology for Teachers (ITT) and Software Applications, Teaching Methods, and Software Development for Teachers (AMDT), both designed with a constructivist approach, were requested by and offered to a cohort of teachers within the systems. Coursework was instructed by the researcher and was designed to prepare teachers to integrate technology into elementary and junior high school classrooms through the use of thematic units.

The purpose of this study was to investigate the learning process of teachers as they begin to implement an innovation. Teachers' changes in attitudes, skills, behaviors, and perceptions of a constructivist approach to coursework were investigated to learn how they effectively integrate technology to support instruction during the first year of implementation. Three questions guided the study.
1. How do teachers’ stages of concerns about technology change after completing ITT and AMDT?

2. How do teachers’ levels of technology use change after completing ITT and AMDT?

3. How do teachers integrate technology after completing ITT and AMDT?

Research Design

A presurvey, Integrating Technology in the Schools (see Appendix I), was adapted from Bissette’s (1998) study and used, prior to coursework, to collect teachers’ demographic and technology-related data and to investigate change in teachers’ technology concern, level of use, and instructional practice. These data included type and number of computers in the classroom, capacity to use computers, daily use of computers to support instruction, percentage of learner-centered instruction, types of software used, and course expectations. Other demographic data were gathered which included gender, ethnicity, years in education, grade taught, certification status, and highest degree held. The survey was administered in September 1999.

The Stages of Concern Questionnaire (see SoCQ, Appendix F) was used to collect data associated with attitudes and skills of technology utilization and integration (Hall et al., 1979). The SoCQ was devised to measure the C-BAM seven stages of concern: (a) 0-Awareness, (b) 1-Informational, (c) 2-Personal, (d) 3-Management, (e) 4-Consequence, (f) 5-Collaboration, and (g) 6-Refocusing. Thirty-five items measuring the seven stages were rated on an 8-point Likert-type scale to measure teachers’ attitudes about and skills associated with technology. The researcher administered the SoCQ during regularly

The Levels of Use (LoU) Interview of an innovation, a focused interview, was used to collect data associated with technology utilization and integration (Loucks et al., 1975). Generic in nature, the LoU provided such detail that questions could be asked about various independent yet related behaviors which contributed to establishing an individual's overall level of use (see Level of Use, Appendix G). Eight levels of use of an innovation are (a) 0-Non-Use, (b) I-Orientation, (c) II-Preparation, (d) III-Mechanical, (e) IV-A-Routine, (f) IVB-Refinement, (g) V-Integration, and (h) VI-Renewal. The researcher administered individual interviews with case study teachers and tape-recorded each session during February and May 2000 to investigate teachers' change in technology use.

An electronic bulletin board was designed and developed by a local Internet provider for the researcher to facilitate discussions of technology utilization and integration. Eight questions (see Electronic Bulletin Board, Appendix J) pertaining to course objectives were developed and posted by the researcher during AMDT. Teacher responses were used to describe individual teacher perceptions about technology and courses. Additionally, data were used to investigate teachers' change in technology concern and level use.

Observation logs (Appendix K), developed by the researcher using Borich's (1996) descriptions for teacher-centered and student-centered instructional practices, were used to identify and investigate teachers' change in instructional practice during AMDT. The researcher video-taped and photographed observations.
AMDT course documents including article critiques, computer logs, software reviews, lesson plans and instructional activity/evaluation handouts, Internet resource list, and products from software applications (Microsoft Word, Excel, Access, and PowerPoint; HyperStudio) were used to investigate teachers’ change in technology concern, level of use, and instructional practice. Data were used to investigate change in teachers’ technology concern, level of use, and instructional practice.

A list of descriptors of a constructivist approach, originally developed by Beller (1998) and adapted by this researcher, was used to compare teacher responses from electronic bulletin board discussions, interviews, and coursework to investigate whether teachers perceived the course to be constructivist in design and whether they were changing to a constructivist approach in their own instructional practice.

Data Analysis

Examining teachers’ changes in attitudes, skills, and behaviors as well as their perceptions of a constructivist approach to professional development required a methodology that allowed for individual thought and expression to be recorded and analyzed. Qualitative methods were of particular value to the study of individuals in educational settings in that they permitted observation of the process of how people come to understand what they experience (Stake, 1995). Lincoln and Guba (1985) recommended looking into the constructed realities of individuals through holistic, contextually situated inquiry. They also stated that within naturalistic inquiry, case study methodology was the best choice for reporting this type of data. (see Components and Sequence of Research Design, Appendix C).
Traditional statistical methods of inquiry, paper and pencil instruments for data gathering and measuring such as C-BAM's SoCQ and LoU, were not sufficient to support the type of study undertaken. Although these data were used to construct teacher profiles and answer the questions that guided the study, the human ability and characteristic to respond and adapt to the situations presented by participants, to process and clarify responses, and to explore and expand on information elicited was of ultimate importance (Lincoln & Guba, 1985). Merriam (1988) supported this perspective in case study research by citing the abilities of the researcher to make situational responses and to make the most of opportunities to gather and elicit more meaningful information. Therefore, data from questionnaires and interviews that measured and analyzed change in teachers' attitudes, skills, and behaviors associated with technology were supported by other research methods.

The researcher used, prior to coursework, a presurvey, Integrating Technology in the Schools (see Appendix I), adapted from Bissette (1998) to collect teachers' demographic and technology-related data. These data included type and number of computers in the classroom, capacity to use computers, daily use of computers to support instruction, percentage of learner-centered instruction, types of software used, and course expectations. Other demographic data were gathered which included gender, ethnicity, years in education, grade taught, certification status, and highest degree held. The survey was used to identify the study's participants, compare baseline technology-related data with teachers' change in technology concern and level of use, construct teacher profiles, and strengthen findings.
The researcher, with the help of an undergraduate student, hand calculated *ITT* Stages of Concern Questionnaires (see Appendix F) in October 1999 and December 1999, and the *AMDT* SoCQs in April and June 2000 using the SoCQ Quick Scoring Device (see Appendix N). Raw data were converted to percentiles and graphed, by the researcher, in an electronic spreadsheet application. Stages were compared to the Concerns-Based Adoption Model's Hypothesized Developmental Stages of Concern (see Appendix D) to identify whether teachers were nonusers, inexperienced users, experienced users, or renewing users and to identify their stage of concern. Once stages were identified, corresponding interventions (see Stages of Concern and Interventions to Facilitate Change, Appendix E) to facilitate change were discussed during coursework. Results and interventions were reviewed individually with teachers during *AMDT* Levels of Use Interviews. Multiple SoCQs were used to investigate teachers' change in technology attitudes and skills, compare to presurvey data, construct teacher profiles, and strengthen the findings.

The researcher, with the help of an undergraduate student, transcribed tape-recorded Level of Use Interviews in April and July 2000. April transcriptions were checked by teachers in May 2000 and July transcriptions were checked by teachers through the use of e-mail. No corrections were necessary. Transcriptions provided the researcher with data to identify representative categories within each level of use. These categories included: Knowledge, Acquiring Information, Sharing, Assessing, Planning, Status Reporting, Performing, and Overall level of use (see Levels of Use Categories, Appendix H). The Level of Use Rating Sheet (Appendix O) was used by the researcher.
to identify a specific LoU. Levels of use were discussed with teachers during the final
days of AMDT. Two LoUs were used to investigate teachers' change in technology
behaviors, compare presurvey and SoCQ data, construct teacher profiles, and strengthen
findings.

The researcher used an electronic bulletin board (see Appendix J) to post reflection
questions regarding the use of technology to support classroom instruction. The researcher
copied case study teacher responses from the electronic bulletin board and pasted
responses into a word processing document. Data were used to investigate change in
teachers' technology concern, behavior, and instructional practice; analyze emerging
categories and themes; construct teacher profiles; compare presurvey, SoCQ, LoU and
descriptors of a constructivist approach; and strengthen findings.

The researcher video-taped and photographed two scheduled classroom
observations (see Observation Log, Appendix K) of case study teachers. The researcher
transcribed video-tape footage to construct teacher profiles. The researcher viewed tapes,
transcripts, and photographs numerous times to describe how teachers were integrating
technology into their classrooms. Data were used to investigate change in teachers' 
technology concern, behavior, and instructional practice; compare presurvey, SoCQ, LoU,
and descriptors of a constructivist approach; construct teacher profiles; and strengthen
findings.

Teachers organized course and classroom documents to include computer logs (see
Appendix L), lesson plans, word processing documents, spreadsheets, databases,
multimedia presentations, article critiques, Internet resource lists, software reviews (see
Appendix R), and electronic correspondence as further documentation of technology use. Data were used to investigate change in teachers' technology concern, behavior, and instructional practice; compare presurvey, SoCQ, LoU, and descriptors of a constructivist approach; construct teacher profiles; and strengthen findings.

The use of "multiple methods in the analysis of the same empirical events" (Denzin, 1989, p.13), or triangulation, assisted in confirming the general findings on teachers' attitudes about technology, behaviors and skills associated with technology, and instructional practices supported by technology. Results, compiled in teacher profiles and tables, assisted the researcher in describing teachers' changes in technology utilization and integration and in learning that interventions were effective in changing teachers' stages of concern and levels of use.

**Participant Selection**

The study was conceptualized in the fall of 1999 when 40 participants enrolled in a university extension technology course, an *Introduction to Technology for Teachers* (*ITT*), offered at two different school sites in northern Louisiana (see *ITT* Syllabus, Appendix A). A teacher from each school was instrumental in requesting the course and identifying the required 15 or more course participants. Participants voluntarily applied, met the criteria, and were enrolled at Louisiana Tech University in the College of Education for the fall 1999 quarter. Based on the study's investigation of coursework impact on teachers' technology use to support instructional practices in the classroom, the researcher selected only teachers from two schools with classroom computers and only those teachers that were participating in both courses.
participants included 32 elementary, junior high, and high school teachers; 2 adult educators; 1 school secretary; 2 computer lab aids; 1 computer lab teacher; 1 principal; and 1 parent center instructor from seven different schools. Each participant completed a presurvey as stated, and data were compiled in Table 1.

Table 1 data revealed 32 participants were classroom teachers from seven different schools, with 20 participants having access to classroom computers. The researcher limited the selection of teachers to the two schools where university extension technology coursework was delivered. Principals, system technology coordinators, and system superintendents appeared to support teachers’ professional development endeavors. One system provided access to a Title 1 computer lab after school. The other system purchased and installed equipment in a new computer lab to facilitate and sustain the integration of technology.

A brief, individually scheduled and tape-recorded LoU interview of teachers with access to computers in their classrooms was conducted in February 2000. Teachers were asked if they understood the statements presented in the SoCQ questionnaire. Teachers were shown their plotted stages of concern and given interventions for each stage. Teachers were asked if they were using technology and if they planned to enroll in the next course. These data assisted the researcher in identifying teachers to include in an in-depth, follow-up case study as shown in Table 2.
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<td>W</td>
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<td>WJH</td>
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<td>Y</td>
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<th>Grade</th>
<th>School</th>
<th>Computer in room</th>
<th>Self-rated tech. skill</th>
<th>E-mail</th>
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<td>F</td>
<td>W</td>
<td>N</td>
<td>K</td>
<td>MOS</td>
<td>Y</td>
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<td>F</td>
<td>W</td>
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<td>BS</td>
<td>7-8</td>
<td>WJH</td>
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<td>30</td>
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<td>N</td>
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<td>HES</td>
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<td>31</td>
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<td>W</td>
<td>14</td>
<td>Y</td>
<td>MS</td>
<td>PreK-4 music</td>
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<td>Y</td>
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<td>32</td>
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<td>N</td>
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<td>5</td>
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### Table 2

#### Case Study Teachers (N=12)

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<th>Grade</th>
<th>Certified</th>
<th>Highest degree</th>
<th>Access to classroom computer(s)</th>
<th>Capacity to use computer(s)</th>
<th>Daily use for instructional support</th>
<th>Learner-centered instruction</th>
<th>Word processing</th>
<th>Spreadsheet</th>
<th>Database</th>
<th>Presentation</th>
<th>Multimedia</th>
<th>Computer-assisted</th>
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<td>W</td>
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<td>1</td>
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<td>50%</td>
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<td>✓</td>
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<td>F</td>
<td>W</td>
<td>18</td>
<td>K</td>
<td>Y</td>
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<td>90%</td>
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<td>✓</td>
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<td>✓</td>
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<td>2</td>
<td>K</td>
<td>Y</td>
<td>BS</td>
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<td>90%</td>
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<td>90%</td>
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Table 2 (continued)

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<th>Teacher</th>
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<td>BS</td>
<td>MS</td>
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Of the 20 teachers with computer access, 6 teachers elected not to take the second course, and 2 did not teach at the schools selected for the study. Data revealed teachers had access to computers and had various levels of skill. Teachers' self-rated capacities to use computers were 5 minimally, 4 comfortably, 2 confidently, and 1 proficiently. Daily use of computers by teachers to support instruction ranged from not at all (0%) to daily (100%). Teachers' use of learner-centered instruction ranged from 0% to 60%. Except for one, all teachers used word processing, six used computer-assisted instruction, two used presentations, and one used multimedia.

Data Collection

Integrating Technology in the Schools (see Appendix I), a presurvey adapted from Bissette (1998), was administered in September 1999 on the first day of an Introduction to Technology for Teachers (ITT). The Stages of Concern Questionnaire developed by Hall et al. (1979) (see SoCQ, Appendix F) was administered on the first day of the course in September 1999 and the last day of the course in November 1999. The use of these instruments was explained to participants on the first day of class; they all agreed to complete the instruments and gave their permission for the researcher to use data for the present study (see Human Subjects Consent Form, Appendix M).

In February 2000, an interview was conducted to identify case study teachers and create teacher profiles, as presented in Chapter 4, containing presurvey and SoCQ data. The Levels of Use Interview developed by Hall et al. (1975) began with the question, "Are you using the innovation?" and dependent upon the response, branched to other questions to determine whether the teacher was a user or nonuser of technology (see Appendix G).
Once use was established, the interviewer continued to probe, collecting evidence to make a decision about the category and overall LoU of the teacher (see Level of Use Rating Sheet, Appendix O). The instrument did not, however, describe how the teacher felt or what caused the teacher to use technology. Therefore, questions examining teachers’ perceptions about coursework experiences and impact on technology integration were also addressed during the LoU interviews.

In March 2000, case study teachers, as well as others from the first course, enrolled in *Software Applications, Teaching Methods, and Software Development for Teachers* (see *AMDT* Syllabus, Appendix B). The Stages of Concern Questionnaire (SoCQ) was administered on the first day of the course in March 2000 and the last day of the course in May 2000. Two classroom observations (see Observation Log, Appendix K) were conducted in April and May 2000 to look for and record changes in instructional practices supported by technology. In April teachers were requested to document personal technology use and student technology use on a daily computer log (see Appendix L). Teachers used an electronic bulletin board during the months of March through May 2000 to reflect on current technology focus questions posed by the researcher (see Appendix J) and used e-mail to confirm data collected by the researcher. In May 2000 teachers compiled course and classroom documents (lesson plans, word processing document, spreadsheets, databases, multimedia, presentations, article critiques, Internet resource lists, software evaluations, and electronic correspondence) in a portfolio. The researcher used this material to learn the impact coursework had on instructional practices. Data collection ended in May 2000.
Coursework

Course goals were aligned with guidelines developed by the *International Society for Technology in Education* (see ISTE Guidelines, Appendix P) that stated teachers should know basic computer/technology operations and concepts, apply technology for their own professional growth and productivity, and support instruction with the use of technology. Activities in *Introduction to Technology for Teachers (ITT)* fostered collaboration in an interdisciplinary curriculum supported by Microsoft’s Office 97 integrated software program.

The second course, *Software Applications, Teaching Methods, and Software Development for Teachers (AMDT)*, was designed to extend teachers’ knowledge and skills from an introductory level to an instructional application level. HyperStudio was introduced and used by participants to cooperatively design a multimedia project for classroom instruction. Other course activities included using the Internet as an instructional resource, evaluating educational software, delivering technology-connected lesson plans, reading and responding to technology reflection questions electronically, critiquing technology articles, and creating a portfolio of course projects.

Setting

The Elementary Cohort

The Title I elementary school served grades pre-kindergarten through four. Enrollment was 653 with 618 (95%) economically deprived and “at risk” students. The ethnic make-up was 22% white and 78% black. The school was located in a small rural...
town in north Louisiana. There were 40 teachers, 9 tutors, 28 regular classes, 3 prekindergarten classes, and 9 special services classes in the elementary school at the time of the study.

The school had a newly implemented technology plan that included the enhancement of teacher effectiveness and student achievement through the use of technology. The plan stated that all teachers were to have opportunities for professional development in the use of technologies that help students meet high academic standards. Teachers were to have access to materials and resources that support the use of technology in teaching, learning, and instructional management.

Prior to the installation of a new lab at the elementary school, elementary teachers traveled to another school within their system to take the first course, Introduction to Technology for Teachers. This lab had been operational for 3 years and was equipped with 25 CompStar computers. Each computer had Windows 98, Microsoft Office 97 Professional, 333 MHz processors, 32 Mb RAM, 2 Gb hard drive, Internet connections, and two networked printers. Although there were Internet connections, line and server problems prohibited Internet use. The lab also had a scanner, phone, and media cart with TV, VCR, computer, and printer. All faculty members and students had access to the lab during normal school hours.

A new lab with 30 networked, 400-450 MHz processors, 64 Mb RAM, 8 Gb hard drive CompStar and Dell computers, and 6 networked printers was operational in February 2000. All computers had Windows 98, Microsoft Office 97 Professional, and HyperStudio 3.1 which met coursework objectives. Internet connections were established
in January 2000. This lab was used by the elementary cohort enrolling in *Software Applications, Teaching Methods, and Software Development for Teachers*. The lab was equipped with a SmartBoard and the school board office occasionally loaned a projector. When one was not available, an InFocus projector owned by Louisiana Tech University was used. A full-time computer lab assistant was responsible for the operation and maintenance of the lab. All faculty members and students had access to the lab.

**The Junior High School Cohort**

The Title I junior high school served grades seven and eight. Enrollment was 537 with 321 (59.8%) economically deprived and “at risk” students. Approximately 65% of the students were from single-parent homes. The ethnic make-up was 40% white, 59% black, and 1% Asian. The school was located in a rural town in north Louisiana.

Although the system had a technology plan, the principal and teachers were not aware of one; therefore, no technology plan was implemented at the junior high school at the time of the study. However, the school Title I program description did describe professional development for a core team of teachers who were to receive intensive training using technology provided with Title I funds for communication, information processing, and productivity. Equipment usage included a digital camera, computers, printers, and scanners to integrate technology into projects in different areas of the curriculum. Only one case study teacher was involved in this program.

The Title I lab used by the junior high school cohort had been operational for 2.5 years and was equipped with 19 networked CompStar computers. Each computer had Windows 95, Microsoft Office 97, 233 MHz processor, 16 Mb RAM, and 2 Gb hard
drive. The lab was set up in a small former classroom. Through additional Title I funding, two digital cameras, a second printer, a scanner, TV, VCR, paper, ink, and educational software were purchased for the lab. One teacher was in the lab on a full-time basis to work daily with approximately 125 Title I students. No other faculty or students used this lab during normal school hours. No printer or Internet connections were available during the first course.

Summary

Using presurvey data, Stages of Concern Questionnaires, Levels of Use Interviews, electronic bulletin board responses, observation logs supported by video-tape and photographs, teacher created portfolios including computer usage logs, and descriptors of a constructivist approach to professional development, this study investigated teacher changes in attitudes, skills, and behaviors associated with technology and perceptions of extension coursework designed with a constructivist approach during 1 year. Coursework goals were aligned with guidelines developed by the International Society for Technology in Education and extended teachers’ knowledge and skills from an introductory level to an instructional application level. The researcher was the instructor and change facilitator.

An in-depth case study of 12 teachers was used to construct an understanding and interpretation of teacher changes and perceptions. Two cohorts of teachers, one elementary and one junior high, were selected by the researcher if they taught in one of the two targeted schools, had computer(s) in their classrooms, and enrolled in two university technology extension courses offered in their schools. Triangulation of
multiple-data-collection methods strengthened the study's usefulness for other settings.

Results and analysis of the data are presented in the next chapter.
CHAPTER 4

RESULTS AND ANALYSIS

Chapter 4 presents results and analysis of the study. The study explored teachers’ changes in attitudes, skills, behaviors, and perceptions of coursework to learn how they effectively integrated technology during the first year of implementation. Teachers participated in two, 10-week, 3.75 hour per week extension courses, an *Introduction to Technology for Teachers (ITT)* in the fall of 1999 and *Software Applications, Teaching Methods, and Software Development for Teachers (AMDT)* in the spring of 2000. Each course was designed with a constructivist approach and goals were aligned with guidelines developed by the *International Society for Technology in Education*. In this chapter are profiles for each teacher, including personal data, figures and descriptions of stages of concern about technology, descriptions of levels of technology use, and descriptions of how technology was used. The study sought to answer the following four questions:

1. How do teachers’ stages of concerns about technology change after completing *ITT* and *AMDT*?

2. How do teachers’ levels of technology use change after completing *ITT* and *AMDT*?

3. How do teachers integrate technology after completing *ITT* and *AMDT*?
The intent of this chapter is to provide the reader with an opportunity for and means of visualizing the coursework and the technology uses experienced by teachers. Data from interviews, observations, e-mail, electronic bulletin board messages, computer logs, and article reviews provided further understanding of attitudes, skills, and behaviors experienced by teachers. Data were used by the researcher in multiple ways. First, data were used to construct teacher profiles which established credibility. Lincoln and Guba (1985) defined credibility as demonstrating that the inquiry was conducted in a manner that ensures the subject is accurately identified and described. The subject was said to be valid when it included in-depth descriptions of the setting, group of individuals, and theoretical framework of the study. Second, data were used to investigate changes and compare teachers perceptions of a constructivist approach and self-reported instructional practices, the researcher demonstrated transferability. Lincoln and Guba (1985) said the external validity of the study can be achieved when the researcher ties data collection and analysis to the theoretical framework of the study. Teachers' stages of concerns and levels of use were compared to the Concerns-Based Adoption Model. Teachers' perceptions about a constructivist approach were compared to descriptors of a constructivist approach (Beller, 1998). Teachers' self-reported instructional practices and the researchers observations of instruction were compared to descriptions of teacher-centered and student-centered practices (Borich, 1996). The triangulation (Denzin, 1989) of data or the use of multiple sources of data to support each point within the study served to strengthen the study's usefulness for other settings. Third, dependability (Lincoln & Guba, 1985) accounted for the changing conditions of what was being studied and what was being
learned. As the researcher attempted to understand how teachers utilized and integrated technology while taking coursework designed with a constructivist approach, the researcher acknowledged that the inquiry takes place in an evolving social system. Fourth, *confirmability* (Lincoln & Guba, 1985) meant that the data should confirm the general findings of the study and lead to implications, not the researcher's evaluation.

In this chapter, general goals, descriptors of a constructivist approach, and expected outcomes will describe the coursework experienced by teachers. A normal development of stages of concern and levels of use will be presented next followed by teacher profiles. A final section will describe patterns and themes that emerged, and finally, a summary of results and analysis will conclude this chapter.

**Coursework**

Course goals were aligned with guidelines developed by the International Society for Technology in Education (see ISTE Guidelines, Appendix P) that stated teachers should know basic computer/technology operations and concepts, apply technology for their own professional growth and productivity, and support instruction with the use of technology. Teachers were provided with a copy of Office 97 for home installation to facilitate and sustain technology usage. Demonstrations in *Introduction to Technology for Teachers (ITT)* of how to use and create a document with each type of application, i.e. word processing, spreadsheet, database, and presentation, preceded teachers working through exercises (DDC Publisher's *Learning Microsoft Office 97*) at their own pace. Activities to apply technology for their own personal use included designing and developing a lesson plan using Word, a spreadsheet with grade calculations using Excel,
a student database using Access, and a class presentation called "All About Me" using PowerPoint. Class discussions between the researcher and teachers included the stages of concern and interventions to facilitate technology usage (Hord et al., 1987).

The second course—Software Applications, Teaching Methods, and Software Development for Teachers (AMDT)—was designed to extend teachers' knowledge and skills from an introductory level to an instructional application level. Teachers used Office 97 applications to deliver technology-connected lesson plans to students in their own classrooms. During AMDT, the teachers had access to other resource materials and software which were taken to the schools during the first few weeks, and had the opportunity to check them out for an extended evaluation. One resource given to each school was a copy of the International Society for Technology in Education’s National Educational Technology Standards for Students (NETS) Connecting Curriculum and Technology (ISTE, 2000). The book was “designed to provide teachers with frameworks, standards, and performance indicators to guide them in establishing enriched learning environments supported by technology” (p. 4).

HyperStudio was introduced and each teacher created a four-card stack on his or her own before cooperatively designing a multimedia project for classroom instruction. Other course activities included using the Internet as an instructional resource, evaluating educational software (see Appendix R), delivering technology-connected lesson plans, reading and responding to technology reflection questions electronically, critiquing technology articles, and creating a portfolio of course projects.
The coursework engaged teachers in active learning activities of inquiry and collaboration, culminating with activities that focused on each teacher's needs. The researcher recognized that teachers were constructing their own knowledge about technology uses and applications based on their own experiences. They were provided opportunities to discuss and reflect beliefs and assumptions about technology use in the classroom. Activities were structured so that new knowledge could build from prior experiences. Each teacher experienced a discord (Piaget, 1954) that needed to be resolved. Technology concerns for self, task, and impact were adjusted or accommodated, and when successful, internalized or assimilated. Finally, the extended period of time, from September through May, provided teachers with sustained, ongoing experiences supported by modeling, coaching, and collaborative problem solving. (See Descriptors of a Constructivist Approach, Appendix Q)

Stages of Concern

The hypothesized development of stages of concern (Hall et al., 1973) for individuals as they initially implement an innovation usually identifies more than one intense concern but still follows one of the patterns of a normal development of stages of concern, according to the Concerns-Based Adoption Model (see Figure 1).

According to the model, nonusers of an innovation have intense Stages 0, 1, and 2 concerns, with low intensity Stages 4, 5, and 6 concerns. As use of an innovation begins, inexperienced users normally have more intense Stages 3, 4, 5 and 6 concerns; and Stages
0, 1, 2 normally decrease in intensity. Stages 0, 1, 2 are associated with self concerns, Stage 3 with task concerns, and Stages 4, 5, 6 with impact concerns. According to CBAM, each stage has its own set of interventions. (See Stages of Concern and Interventions to Facilitate Change, Appendix E) These are the developmental stages of concerns that case study teachers would be expected to exhibit during the first year of implementation, according to the theory.
Levels of Use

This instrument addresses what a teacher is doing or not doing in relation to the innovation. Hall & Loucks (1977) stated that 60 to 70% of all first-time innovation users achieve and remain at a mechanical level for an extended period of time. This level is defined as a state in which the user focuses most effort on the short-term, day-to-day use of the innovation with little time for reflection. Changes in use are made more to meet user needs than, in this case, student needs. The user is primarily engaged in a stepwise attempt to master the tasks required to use the innovation, often resulting in disjointed and superficial use. This is the level of use that case study teachers using technology for the first time would exhibit during the first year of implementation, according to the theory.

Profiles of Teachers

Kim

With 3 years of first-grade teaching experience, Kim initially rated her computer proficiency as a 3 on a scale of 0 (none) to 4 (proficiently) during presurvey (Integrating Technology in the Schools-A Presurvey, 9/99) data collection. In October 1999, she purchased a home computer which aided in the completion of course assignments and school activities as outlined in an Introduction to Technology for Teachers (ITT). She also had Internet access; however, she did not routinely use it to correspond with the researcher.

Her classroom had two CompStar computers with 266 MHz processors, 32 Mb of RAM, and 2 Gb hard drives and one HP/Vectra 486 with 33 MHz and 8Mb of RAM.
support her self-reported 50% learner-centered instruction (Integrating Technology in the Schools-A Presurvey, 9/99). The classroom had one printer and Internet connection.

Kim was already using technology before ITT (Integrating Technology in the Schools-A Presurvey, 9/99). She primarily used word processing to produce lesson plans, letters, and fliers. Her 24 students were scheduled to rotate through the three classroom computers—first for educational software games (Reader Rabbit, Franklin Learns Math, and Arthur's First Grade) between 8:30 a.m. and 9:00 a.m. to reinforce basic language and math skills, and second for Accelerated Reader between 1:40 p.m. and 2:00 p.m. (see Software Reviews, Appendix R). This schedule typically provided 30 minutes of weekly access per student (memo, 3/8/00).

Expectation for ITT was “How to integrate technology better” (Integrating Technology in the Schools-A Presurvey, 9/99). During ITT, Kim learned how to use and apply integrated software; however, she only thought presentations would be appropriate in her class to support instruction. During Software Applications, Teaching Methods, and Software Development for Teachers (AMDT), her personal use of technology averaged 5.5 hours per week and was primarily for working on course assignments (Computer Usage Logs, 3-5/00). Kim accessed the Internet for additional teaching resources. She wrote,

The Internet offers such an enormous array of information it is almost mind boggling. The difficult part is sorting out all the fluff to find the really useful stuff. Websites like the ones you listed are good for helping teachers. However, I was not particularly impressed by the Madlibs, though. They might be slightly useful in reinforcing the parts of speech, but other than that they don't seem terribly useful. The other two websites [WebQuests] were a bit overwhelming for me. They used a lot of technical jargon that I found hard to understand. They do seem like they would be very useful to a teacher with older students. I do not think I could use much from them with my first graders. I may be underestimating them, but I think I have to do the research, and they can look at it or play games with it.
If I were an upper-elementary or junior high teacher, I would be very interested in these sites. One WebQuest site did seem a little closer to my level than Madlibs. The other may have been, but I couldn't figure it out enough to find any lower-level things. They seemed mostly to guide students into doing their own research using the Internet. (bulletin board, 4/4/00)

Kim never logged her students' use of technology while in the computer lab; however, she had the following to say about her experience in using the lab.

By the time you call up 30 new websites you have used up your time in the lab. We had to use what the prior class was using. I feel like we have to do whatever is up. It is beneficial I think to the point that it gives them more exposure to computers. One day they did math flash cards which I guess is good, but there is so much more they could be doing. They also played Memory. That is all we have accomplished so far, but that is 30 minutes out of my time that we could be doing something else. They enjoy going and I want them to get used to it. We are scheduled for Monday and Thursday but Monday I have a guest that comes in and works with the kids so we don't go on Monday. What somebody has suggested is to find out who comes after you, and each of you block an hour of time one day a week instead of two ½ hour days. (bulletin board, 3/21/00)

Kim thought an article by McKenzie (1998), which talks about using the Internet effectively in the classroom, was informative; however, she was not yet able to find an application for her students to use in the classroom or in the computer lab. As stated earlier, Kim was already using technology for her personal use and had a limited selection of educational software for her students to use in the classroom. On April 4th, she evaluated Read, Write, and Type! and Storybook Weaver Deluxe (see Software Reviews, Appendix R); however, she did not mention planning to integrate them into the classroom when interviewed at the end of AMDT.

Kim had already developed and delivered a PowerPoint on poems and the solar system (Level of Use, 2/4/00) to students in her classroom. During AMDT, her group was developing a PowerPoint presentation on insects.
Our group is developing a PowerPoint show to be used on one computer like an animated book. Our topic is insects. The students will be able to sit down at the computer and read the book and enjoy the graphics that go with it. It will be an informational books with facts about several different insects. After the students have completed their unit on insects, we could extend this by having them make their own page to the book. The main concern I have is the time it will take them to type in their information. (bulletin board, 3/20/00)

The standards I will be covering with this book are in two different areas. The first is science. The students are required to learn about insects in a variety of ways including: living things versus non-living things, the body parts of insects, and the different life cycles of insects. The other standards are in the areas of reading and writing. The students are required to read and write for a variety of purposes. (bulletin board 4/3/00)

On May 2nd, the researcher observed a lesson that Kim developed and designed with the help of Claudia, another case study teacher, and Ashley, a course participant not included in the study. The researcher video-taped and photographed the observation. Her objectives were to compare and group insects, according to likeness and differences, read independently, and understand vocabulary. The presentation, the second delivered to the whole class using a TV/media cart, included seven insects and one spider. Characteristics, the text sections, were enhanced with clipart and sounds from the Microsoft Clipart Gallery website.

The researcher observed Kim as she turned on the presentation and watched the students focus their attention to the TV when they saw the insects on the screen. “Okay, we have been learning about insects and spiders. Tell me something about spiders.”

A few students yelled, “They have eight legs!”

“Good,” Kim replied, “what else? What is the word that means ‘chest’?” Kim proceeded to ask open-ended questions, recall facts and word meanings, and provide
feedback. She also drew from examples of students' own experiences, interests, and problems. "Why do you see ants at picnics?"

One student shouted, "Because when you take your food they want to come and eat it!"

"Okay, good, now what insect that we have learned about and that you see up here comes after 'A' in the alphabet?" When the students recalled "B," Kim told them that the insects presented would be in alphabetic order. As she introduced the bumblebee, she also had them recall what they learned about bees and plants. "How many of you have picked a honeysuckle and eaten the nectar?"

It was getting so loud that one of the students yelled at the class to be quiet. Kim, however, seemed unaware of all of the noise. With only the title slide and two insect slides down, the classroom lost power. Someone had used the microwave in the teachers' lounge.

After several minutes of unsuccessful attempts to revive the power, Kim kept the momentum by passing out insect activity sheets. The students were instructed, "Use your knowledge of the alphabet to put the insect pages in alphabetical order; color the insects and make a book." In closing, Kim told her students the presentation would be continued on another day.

When comparing the researcher's observation data to Kim's self-reported instructional practice, 50% learner-centered, Borich's (1996) descriptions of student-centered instructional practices (see Observation Log, Appendix K), and descriptors of a constructivist approach (see Appendix Q), Kim was found to be practicing a teacher-
centered, direct instructional approach supported by technology. A constructivist approach was not observed. PowerPoint met her needs and the students loved it (Level of Use, 2/4/00). However, she was "not sure first graders could handle PowerPoint independently" (bulletin board, 3/20/00) so students were not given the opportunity to use PowerPoint for themselves.

Her experience with HyperStudio revealed the same perception. She reported, "A student-created HyperStudio project would probably only work with much older children because HyperStudio is so complicated to work with." However, before the end of AMDT, she began to plan for and design a seven-card HyperStudio stack on dinosaurs. Her storyboard included characteristics and pictures of meat- and plant-eating dinosaurs. A lesson plan was not turned in for this activity.

According to her statements on the influence of technology for teaching and learning, Kim reported the following:

As a student, the only influence that technology has had on me is the work in your classes. As a teacher I find that it is influencing me in many areas. From simply typing a word list to send home with students to trying to integrate its use in the classroom, I encounter it daily. Lesson plans on the Internet are a great help in my class plans. The wonderful pictures I find on the Internet really bring things to life for whatever subject we are studying in class. I also use technology by illustrating poems with PowerPoint for my students. In the classroom my students are still mostly using technology for drilling skills. (bulletin board, 3/7/00)

According to the Concerns-Based Adoption Model, Kim’s stages of concerns, as presented in Figure 2, revealed that she had intense self and impact concerns.
ITT and AMDT SoCQs identified an inexperienced user, resistant to the innovation in November 1999 and March 2000. Stage 1, 2, and 6 (Informational, Personal, and Refocusing) self and impact concerns were the most intense during ITT SoCQs. Stage 2, 4, and 6 (Personal, Consequence, and Refocusing) self and impact concerns were the most intense during pre-AMDT, and Stage 2, 4, 5, and 6 (Personal, Consequence, Collaboration, and Refocusing) self and impact concerns were the most intense during post-AMDT. Stage 0 (Awareness) concerns were the least intense for both ITT and AMDT SoCQs. According to the model, intense self and impact concerns would be normal given the fact that she was still learning how to use technology for personal and professional needs. According
to other data collected, Kim had limited use of word-processing, presentation, and the Internet prior to ITT (Integrating Technology in the Schools-A Presurvey, 9/99). The SoCQ results alerted the researcher as change facilitator to Kim’s concerns about self and impact. During coursework and interviews, the researcher, as instructor and change facilitator, modeled and facilitated technology tools in a variety of ways - individually, in groups, and through an electronic bulletin board. The researcher applied interventions suggested in the concerns-based model to encourage a dialog about technology, incorporate the use of technology in small, sequential steps, and to continue collaborating with others in developing technology activities to support instruction. The ongoing, sustained coursework enabled Kim to engage in learning activities in which she could construct her own knowledge about technology integration and could resolve her self concerns. She applied integrated software to meet her classroom needs by developing, designing, and delivering an instructional lesson supported by technology. She accessed the Internet, evaluated sites, and created her own teacher resource Internet list. She evaluated educational software for classroom use. She reflected on technology articles. She reflected on technology questions raised by the researcher and posted responses on an electronic bulletin board. According to the model, as Kim becomes more experienced she would be expected to change concerns from self and task to impact concerns. Stage 0 and 1 (Awareness and Informational) self concerns had lessened and Stage 4, 5, and 6 had intensified from September 1999 to May 2000.

Throughout the coursework, Kim sought information about technology and discussed the uses of technology with others in her cohort and within the school who were
not taking the coursework. "Some of the teachers have come by while I was doing PowerPoint and I have about five teachers that are insisting I come and teach them" (Level of Use, 2/4/00). She had been thinking about how to evaluate the use of technology.

Well, one thing that they have encouraged us to do on the technology committee is to make sure that the programs we are using are programs that you can go in and get the percentage of what students have done, how much they did correct, and how much progress they have made. So I am trying to make sure that everything that I do is like that. (Level of Use, 2/4/00)

Kim also wanted to integrate technology. "Next year I really want to have more big things. Not just do Reader Rabbit. I want something that integrates into the whole process" (Level of Use, 2/4/00). "I am using a lot of word processing for word lists that the students have to use and for letters home to parents. The only things I have started using since the end of the course (ITT) are PowerPoint and the Internet" (Level of Use, 2/4/00). I have a couple of poems that I put on PowerPoint to build students' writing skills, but until I have the time to plan and manage other activities, the students are limited to using educational software programs to reinforce basic skills (Level of Use, 5/1/00).

According to the Concerns-Based Adoption Model, Kim's level of use, as measured by two Level of Use (LoU) interviews, was a Level III (Mechanical) for utilization and integration of technology at the beginning of February 2000 and May 2000. According to the model, Kim was already using technology for her personal needs. Her self-reported confident computer using proficiency (Integrating Technology in the Schools-A Presurvey, 9/99) supports LoU data. However, after AMDT, data collected in bulletin board responses, LoU interviews, observations, and computer logs revealed that she was now aware of ways to apply integrated software and other (HyperStudio, Read,
Write, & Type!, and Storybook Weaver) technology tools to support instruction. Now Kim was focusing most of her effort on the short-term, day-to-day use of integrating technology to support classroom instruction with little time for reflection. She was primarily engaged in a stepwise attempt to master the tasks required to integrate technology into the classroom. According to the model, as Kim becomes more experienced she would be expected to change her technology use from day-to-day to ongoing, practicing a variety of technology supported activities that impact her students and colleagues. According to the model and to researchers referred to in the literature review, Kim needed additional time to plan, implement, and evaluate new technology tools to support her classroom instruction. Consequently, through her own accommodation and assimilation, Kim was found to be resolving concerns and changing her level of use. Coursework designed with a constructivist approach was found to facilitate Kim’s technology integration. Kim was also taking other steps to facilitate her technology integration by serving on a technology committee, assisting colleagues with technology development and implementation, and enrolling in additional technology coursework (Level of Use, 2/4/00 and 5/1/00). Triangulation of other data collected in electronic bulletin board responses, observation logs including video-tape and photographs, computer logs and other course documentation (course assignments and presentations) supported Kim’s SoCQ technology concerns and LoU technology usage.

**Christy**

With 18 years of kindergarten teaching experience, Christy initially rated her computer proficiency as a 2 on a scale of 0 (none) to 4 (proficiently) during presurvey
(Integrating Technology in the Schools-A Presurvey, 9/99) data collection. She had a home computer which aided in the completion of course assignments and school activities from the start of *Introduction to Technology for Teachers (ITT)*. However, she did not have access to the Internet. Her classroom had two CompStar computers with 266 MHz processors, 32 Mb of RAM, and 2 Gb hard drives to support her self-reported 90% learner-centered instruction (Integrating Technology in the Schools-A Presurvey, 9/99). There was one Internet connection in the classroom. Christy also had a full-time paraprofessional.

Christy was already using technology before *ITT* (Integrating Technology in the Schools-A Presurvey, 9/99). She used word-processing to produce lesson plans, letters, and school forms. Her 14 students, with the support of Christy or the paraprofessional, used the classroom computers 3 days a week for educational software games (Reader Rabbit Preschool, Franklin Learns Math, and Sticky Bear Shapes) to reinforce basic language and math skills (see Software Reviews, Appendix R). Typically, each student was provided 15 minutes of access per day (memo, 3/8/00).

This teacher was instrumental in forming the cohort of elementary teachers and requesting that the extension course be offered at a school in her system. Expectation for *ITT* was to “gain computer skills to help my students enhance lessons and increase my own computer knowledge” (Integrating Technology in the Schools-A Presurvey, 9/99). During *ITT*, Christy learned how to use other tools (spreadsheets, databases, and presentations), but thought only presentations would be appropriate in her class to support instruction. Her personal use of technology during *Software Applications, Teaching*
Methods, and Software Development for Teachers (AMDT) averaged 7 hours per week and was primarily for creating school-related forms and memos (Computer Usage Log, 3-5/00). During AMDT, Christy accessed the Internet for additional teaching resources.

Websites that help a teacher to compile useful information to plan lessons within a certain theme will be of great help! Filamentality, the last website, is a fill-in-the-blank interactive website that guides you through picking a topic, searching the web, gathering good Internet sites, and turning web resources into learning activities. Support is built in through Mentality Tips, so you'll be guided along the way and end up with a web-based activity you can share with others. Even with the tips, I would need help to use this site for my level. I had trouble getting to the other two sites. I thought the Madlib site was great, but found the number of questions to be a little long. This activity would be too long and difficult for the K students in my class. A shorter story with fewer questions might work as a group activity. They would love the humorous story but would have to have a lot of guidance to complete the activity. (bulletin board, 4/4/00)

Christy and her paraprofessional accompanied the students to the computer lab for 30 minutes on Tuesday and Wednesday to access websites (PBS). During one video-taped and photographed observation by the researcher on April 11th, the researcher noted that it required all three adults (the school has a full-time computer aid) to assist the students. The students were working on the letter “B,” noting differences and similarities. The researcher noted that some students knew what to do while others did not.

As stated earlier, Christy was already using technology for her personal use and had a limited selection of educational software for her students to use in her classroom. She evaluated Storybook Weaver Deluxe and Let’s Start Learning and later designed and delivered three thematic lessons; one using PowerPoint, a second using Storybook Weaver Deluxe, and a third using HyperStudio (see Software Reviews, Appendix S). Carol Ann, a prekindergarten teacher at Christy’s school, enrolled in the course but not involved in the case study, helped Christy locate Louisiana theme pictures on the Internet. Kathy, a
cohort in the study, was instrumental in adding sounds for the presentation and in
designing the HyperStudio stack.

Our group decided to do a PowerPoint presentation on Louisiana, since we teach
a unit on our state in kindergarten and preschool. The presentation highlights the
state symbols and uses simple-sentence form to describe/name each symbol. We
hope to later add sound to each page of our presentation. This activity can be
presented to a whole group by the teacher, used at a computer center for students
to explore, and shared with other teachers. We hope to make a "little book" for
students that relates to the same language development skills as the presentation.
Teachers at higher levels can expand our activity by adding activity pages or more
detailed state information to our presentation. (bulletin board, 3/21/00)

The unit on Louisiana was delivered during the final day of AMDT and was
included in Christy's portfolio. The objectives for the Louisiana unit stated that students
would be able to (a) recognize the state of Louisiana by its shape and its location on the
map of the United States; (b) identify and recognize the state flag, state bird, state flower,
state tree, and state dog through the use of class activities and the computer activities; and
(c) discuss Mardi Gras, the major celebration in the state, by participating in Mardi Gras
activities and related computer activities. The presentation included pictures and sounds
from the Internet (www.state.la.us) for each of the items identified in the objectives. The
lesson culminated with a "little book" which, according to Christy, would evaluate
language development skills through its use.

Christy designed and delivered, as stated, two more integrated lessons with the
help of two teachers in her cohort, and these were based on a farm theme. No lesson plan
accompanied these activities, but she had mentioned general objectives that she followed
from a program called LEAD. "It asks students to name the food, describe the food, and
tell where we get the food” (bulletin board, 3/21/00). Using the Storybook Weaver Deluxe program, Christy said,

We talk about authors, so we put their name in (the students). We talk about the type of book and who wrote the book, so it fits right into this theme. The students helped name farm animals, pick out pictures of the animals, and tell something about them. It (the program is categorized) contains pictures and sounds. Everything is right here. (bulletin board, 5/9/00)

On May 9, the researcher observed Christy's classroom instruction. The observation was video-taped and photographed. After giving the researcher some background on the two computer activities, she motioned for the paraprofessional to select two students to come to the computer. As they approached the computers, the paraprofessional sat between them. Christy went to other centers to assist other students. On the wall behind the computers was a beautiful mural of a farm scene with cows, goats, chickens, pigs, a dog, a horse, a farmer, and children. The screen of the computer with the HyperStudio farm stack displayed the home card with a barn in the center and six farm animals surrounding it. When the student clicked on an animal, it would make the appropriate animal sound and transition to a card with the same animal. For example, when a student clicked on the horse, that card would go to another card with 12 horses. The student would count the number of horses, then pick the appropriate number from three numbers displayed at the bottom of the card. If the correct number was clicked, “yee haw” sounded and returned the student to the first card to pick another animal. If the student picked the wrong number, a card saying “oops” would appear, then return the student to the previous card to try again. If the pig was clicked on the home card, that card would go to another card with a pig in the center and three letters displayed at the bottom.
If the student picked the letter that correctly began the word "pig" they would again hear "yee haw" and return to the home card. Two other cards contained a picture of a cow and a chicken. At the bottom of those cards food products were displayed. The students had to correctly click on the product of the cow or chicken. The students needed little or no instructional guidance.

Christy returned periodically to check on the paraprofessional and students. Ten minutes into the lesson, Christy switched places with the paraprofessional. The second computer activity was designed with Storybook Weaver Deluxe and looked like a book. Students had to click the arrow to go from one page to another, similar to turning a page. While on a page, they would read the name of the animal and the description of the animal. They would tell something about the animal as the paraprofessional listened and, if needed, assisted. Christy prompted them to click on the animal so they could hear the animal sound. Several students mimicked the sounds and laughed. Questions like "Where do we get milk from? What did you have for breakfast this morning? What is the baby chicken called?" guided discussion and informal assessment. The researcher noted that the students were smiling throughout the activity. Assessment of both activities was evident. Christy even announced, "Next year I am going to make a different story for each theme."

When comparing the researcher's observation data to Christy's self-reported instructional practice, 90% learner-centered, Borich's (1996) descriptions of instructional practices (see Observation Log, Appendix K), and descriptors of a constructivist approach (see Appendix Q), Christy was found to be practicing a student-centered, constructivist approach supported by technology.
Several years ago I realized the teaching skills and methods I learned 10 (or more) years ago were not suited to the time we are living in or the children we are teaching. Advancements in technology and the increased availability of it for home and school use have encouraged me to develop new skills. I use the computer at home and with my family as a resource, word processor, and learning tool. As a teacher, I produce student activities, assessments, notes to parents, and use it as a resource tool. The computer is used with my kindergarten students to reinforce the readiness skills being taught. (bulletin board, 3/14/00)

According to the Concerns-Based Adoption Model, Christy's stages of concerns, as presented in Figure 3, revealed that she had intense self and impact concerns.

Figure 3. Christy's stages of concern
ITT and AMDT SoCQs identified an experienced user, receptive to the innovation. Stage 1, 2, and 5 (Informational, Personal, and Collaboration) concerns were the most intense during ITT, and Stage 1, 2, 3, 4, 5, and 6 (Informational, Personal, Management, Consequence, Collaboration, and Refocusing) concerns were intense during AMDT. Stage 0 (Awareness) concerns were the least intense in both ITT and AMDT SoCQs. According to the model, intense self and impact concerns would be normal, given the fact that she was still learning how to use technology for personal and professional needs. According to other data collected, Christy used word-processing for her personal and professional needs (Integrating Technology in the Schools-A Presurvey, 9/99). The SoCQ results alerted the researcher as change facilitator to Christy’s concerns about self and impact. During coursework and interviews, the researcher, as instructor and change facilitator, modeled and facilitated technology tools in a variety of ways—individually, in groups, and through an electronic bulletin board. The researcher applied interventions suggested in the concerns-based model to encourage a dialog about technology, incorporate technology in small, sequential steps, and to continue collaborating with others in developing technology activities to support instruction. The ongoing, sustained coursework enabled Christy to engage in learning activities in which she could construct her own knowledge about technology integration and could resolve her self concerns. She applied integrated software to meet her classroom needs by developing, designing, and delivering an instructional lesson supported by technology. She accessed the Internet, evaluated sites, and created her own teacher resource Internet list. She evaluated educational software and designed two technology activities that supported her instruction. She reflected on
technology articles. She reflected on technology questions raised by the researcher and posted responses on an electronic bulletin board. According to the model, as Christy becomes more experienced she would be expected to change concerns from self and task to impact concerns. Stage 0 (Awareness) self concern had lessened and Stage 4, 5, and 6 had intensified from September 1999 to May 2000.

Throughout the coursework, Christy's use of technology focused on personal, student, and colleague needs. "I write letters to parents, create skills checklists, and design cover sheets for our tests. During noninstructional time, I work as a coordinator creating certificates, inventory forms, programs, teacher memos, notes, and schedules" (bulletin board, 3/21/00).

According to the Concerns-Based Adoption Model, Christy's level of use, as measured by two Level of Use (LoU) interviews, was a Level II (Preparation) for utilization and integration of technology at the beginning of February 2000 and a Level IVB (Refinement) at the beginning of May 2000. According to the model and other data collected, Christy was already using technology for her personal needs. Her self-reported comfortable computer using proficiency (Integrating Technology in the Schools—A Presurvey, 9/99) supports LoU data. However, after AMDT, data collected in bulletin board responses, LoU interviews, observations, and computer logs revealed that her usage developed from personal use of word processing to integrating PowerPoint, HyperStudio, Storybook Weaver Deluxe, and the Internet into her thematic instruction. According to the model, Christy had advanced from preparing for her first use of technology integration to varying the use of technology for the purpose of increasing the impact on
students and colleagues. Variations were based on knowledge of both short- and long-term consequences for students and colleagues. According to the model and to researchers referred to in the literature review, Christy needed additional time to plan, implement, and evaluate new technology tools to support her classroom instruction. Consequently, through her own accommodation and assimilation, Christy was found to be resolving concerns and changing her level of use. Coursework designed with a constructivist approach was found to facilitate Christy's technology integration. Christy was also taking other steps to facilitate her technology integration by assisting other colleagues with technology development and implementation and enrolling in additional technology coursework (Level of Use, 5/2/00). Triangulation of other data collected in the presurvey, electronic bulletin board responses, observation logs including video-tape and photographs, computer logs and other course documentation (course assignments and presentations) supported Christy's SoCQ technology concerns and LoU technology usage.

Sandra

With 13 years total experience, including 4 years of noncategorical preschool special education, Sandra initially rated her computer proficiency as a 1 on a scale of 0 (none) to 4 (proficiently) during presurvey (Integrating Technology in the Schools-A Presurvey, 9/99) data collection. Her classroom had one CompStar computer with 233 MHz processor, 32 Mb of RAM, and 2 Gb hard drive to support her instruction. Sandra reported using 90% learner-centered instruction (Integrating Technology in the Schools-A Presurvey, 9/99). Sandra had two full-time resource aids.
Sandra had a very limited use of technology before *Introduction to Technology for Teachers* (*ITT*) (*Integrating Technology in the Schools-A Presurvey, 9/99*). She primarily used her classroom computer to produce Individual Evaluation Plans (IEP). She did not have a computer at home during *ITT*. Expectation for the course was “I expect to learn how to use the computer for my work and home. I am getting one for Christmas, and I want to really be knowledgeable” (*Integrating Technology in the Schools-A Presurvey, 9/99*).

As Sandra learned how to use other tools (spreadsheets, databases, and presentations) during *ITT*, her technology use and her student's technology access remained unchanged. It wasn't until she purchased a computer for home use, in December 1999, that Sandra found herself “playing” on the computer. Her personal use of technology averaged 10 hours per week and was primarily for Internet and e-mail (*Computer Usage Log, 3-5/00*).

I knew absolutely nothing about the computer. I was computer illiterate, but now I feel somewhat more secure about using this form of technology. I am not afraid of trying it now. I can now send notes home that I create in word. It makes the work I do seem more professional. (e-mail, 1/5/00)

My home computer is used a lot by my family to play games, visit websites, and access e-mail. It's fun to open e-mail and then send it to friends. It has created a new form of communication for my friends and me. (*Computer Usage Log, 4/00*).

With this new awareness Sandra increased her usage of the school computer. She worked individually with students using the computer between 9:30 a.m. and 10:30 a.m. on Monday and Wednesday. This schedule typically provided each student with 10 minutes of access twice a week (*memo, 3/8/00*). Initially, she accessed websites located at home (PBS, Henson, Nick Jr., and the Children's Television Workshop) which...
reinforced basic skills. Later, as Sandra progressed through *Software Applications*, *Teaching Methods*, and *Software Development for Teachers (AMDT)*, she continued to search the Internet for additional teaching resources.

I totally agree that the web offers itself as an unlimited resource for students. I think that teachers must first use the websites to become aware of what the students are to be engaged in. Teachers need to find educational sites that have information which assists or enhances the lessons taught in the classroom. It is hard to tell someone else what to do or even adequately supervise something as infinite as the web if you are not informed and comfortable with it. (bulletin board, 4/2/00)

After reading an article about preservice special education teachers’ knowledge of technology, Sandra said,

This article calmed my mind. It let me know that just because I have a degree, I still may not have been adequately prepared. I didn’t get much hands-on experience with technology. I don’t want to use this as a “cop-out,” but at least I don’t think it’s totally my fault for not knowing some of these things. It just tells me that I have to go to workshops and classes to upgrade myself on the things I don’t know. (article review, 4/18/00)

Two projects that Sandra designed with the help of two other cohort teachers not included in the study, involved interdisciplinary lessons using PowerPoint and Word. The presentation presented A-B-Cs and 1-2-3s on seven slides, the first being a title slide. Each slide had A-B-C and 1-2-3 centered at the top. She used clipart of an apple, balloon, racecar, flower, turtles, and stars. She enlarged her letters and numbers to a size 36 font to enable the students to see them more clearly.

On April 18, Sandra sat in front of her computer with five students crowding around her. She had to lean in front of them over the keyboard to block them from pressing the keys as she booted her computer for the first time that day. It took her a few minutes to get ready because she had forgotten to remove a disk from the floppy drive.
When the Windows 95 screen popped into view, Sandra got their attention by pointing to different colors and asking them to name the color. Several students starting yelling, "I want my race car!", anticipating the picture of a car on the "C" slide.

Sandra calmly replied, "Are you ready to do the A-B-Cs? What color is the A?" As each student identified the color, she gave him or her positive feedback. "What is this picture for A? Good, an apple. What letter comes next? What does it stand for?" When the racecar slide came up, all of the students screamed with delight. "Okay, everybody wants a racecar, but let's look at what comes next. How many flowers do you see next to this number? What number is this? Can you count them?" As she completed each number slide, she would say, "A-B-Cs and 1-2-3s." She also held up her fingers to show the students how many. If they could not tell her how many, she would have them hold up as many fingers as she was showing, then they would touch each other's fingers. The students started to get a little fidgety as the last slide appeared. "Okay, finished. Now let's go over there and play a game."

Two of her aids assisted her in seating the students on the floor in a circle. Each student was given a little wooden boy or girl figure and a laminated sheet of the slide presentation in color, six slides per page size. Sandra held a little wooden figure of a lady as she requested, "Tell the teacher 'hello'."

The students all giggled as they replied, "Hello."

"Now teacher says you have to find the ABC and 123 when she tells you to. Teacher says put your friend on the A." Only one student did it by himself. The others needed assistance from the teacher and the aids. "Everyone have their friend on the A?
Yes? Good. Your friend is glad because you are doing what the teacher says. Your friend is so happy.

By the third slide, the students needed less assistance as they realized what they were supposed to do. When the activity was complete, Sandra said, “Teacher says clap your hands.” They did and then before they could get up, and some were more than ready by this point, Sandra said, “Teacher is going to tell your friend you did a good job and you can go and play. Let me see your friend.” She placed her figure in front of the first student’s figure and in a tiny voice said, “You did good. You can go play.” He laughed and raced off to play. She did this with the rest of the students, producing laughter, and only one appeared to have had enough of the activity.

Her second activity a few weeks later, on May 9, used a word-processing document to produce a letter and picture for each student’s mother for Mother’s Day. Each student was to type the word “love” and his or her own name, then Sandra would print it along with a page containing a picture of a flower that they would color. This activity proved a little harder to manage. One student at a time sat with Sandra at the computer. She had red stickers on the L, O, V, and E keys to help the students find them. She put a color of the student’s choice on the letters within their first and last names.

Pointing to the keyboard, she said, “Where is the L? Look. Look. Don’t go so fast. We aren’t going to be able to do anything. It won’t work. Okay, thank you. Let’s see if we can get this back.” The student had a hard time identifying the proper key and pressing the key just once. “Where is the L? It is on the second row. See the L on the paper. See the L on the keyboard. It has a red sticker.” As the student pressed the key several times, Sandra whispered, “Wait; just one.” She then gently pulled his hand away from the
keyboard. The activity appeared to get more frustrating for Sandra, as she replied, "Oh, boy." The letter finally emerged from the printer; the student grabbed it and ran toward the middle of the classroom.

A second student appeared more prepared. "Do my name. I want purple."

Sandra reached for the sheet of stickers, pulling a purple sticker for every letter in the student's name. "Okay, I will put one on every letter in your name. Is that all right?"

As the student said, "Yes," Sandra was relieved. "I sure am glad you said that."

She read from the screen, "This says LOVE." Then she read from a piece of paper near the keyboard, "This says 'Tray'[she read both his first and last name]. The word LOVE is in red on the keyboard. If you press the correct red dots you can print the word. What is the first one? Watch. One time. There you go. See."

Finding the letters for the word took time; the student said, "I want todo my name."

"I promise you we will," sighed Sandra. "Do the E. Guess what we are going to do now?"

"What?" replied the student.

"We are going to type your name." Sandra printed the letter after the student typed his first name, deciding that it would be too much to expect him to type his last name too.

When comparing the researcher's observation data to Sandra's self-reported instructional practice, 90% learner-centered, and Borich's (1996) descriptions of student-centered instructional practices (see Observation Log, Appendix K), and descriptors of a constructivist approach (see Appendix Q), Sandra was found to be practicing a student-centered, constructivist approach supported by technology. The instructional activities
integrating technology were Sandra's first. The presentation offered a way to extend students' recognition and understanding of numbers and the alphabet. Her assessment was, "I can see and hear if they can do it." Although, the Word activity proved to be more difficult than she had imagined, she remained optimistic about using technology.

As of right now, technology has influenced me more as a learner than as a teacher. I have had the opportunity to become familiar with a whole new world. I am still not an accomplished technological person, but I am much more advanced than before I began taking these courses. I presently use technology on a limited basis in my classroom. I am looking for ways to develop ideas for technology to be used with noncategorical preschool. I don't have children who are capable of using technology. (bulletin board, 3/21/00)

According to the Concerns-Based Adoption Model, Sandra's stages of concerns, as presented in Figure 4, revealed that she had intense self and task concerns.

ITT and pre-AMDT SoCQ identified an inexperienced user, resistant to the innovation with intense Stage 0, 1, 2 and 3 (Awareness, Informational, Personal, and Management) concerns. Sandra had intense Stage 0 and 3 (Awareness and Management) concerns for post-AMDT. Her least intense concern was Stage 5 (Collaboration). According to the model, her intense self and task concerns would be normal given the fact that she was still learning how to use technology for personal and professional needs. According to other data collected, Sandra was just learning about technology this year (email, 1/5/00). The SoCQ results alerted the researcher as change facilitator to Sandra's concerns about self and task. During coursework and interviews, the researcher, as instructor and change facilitator, modeled and facilitated technology tools in a variety of ways-individually, in groups, and through an electronic bulletin board. The researcher applied interventions suggested in the concerns-based model to encourage a dialog about
technology, to incorporate the use of technology in small, sequential steps, and to continue collaborating with others in developing technology activities to support instruction. The ongoing, sustained coursework enabled Sandra to engage in learning activities in which she could construct her own knowledge about technology integration and could resolve her self concerns. She applied integrated software to meet her classroom needs by developing, designing, and delivering an instructional lesson supported by technology. She accessed the Internet, evaluated sites, and created her own teacher resource Internet list. She evaluated educational software for classroom use. She reflected on technology articles. She reflected on technology questions raised by the researcher and posted
responses on an electronic bulletin board. According to the model, as Sandra becomes more experienced she would be expected to change concerns from self and task to impact. Stage 0, 1, 2, and 3 (Awareness, Informational, Personal, and Management) self and task concerns had lessened from September 1999 to May 2000.

Sandra knew nothing about technology when she signed up for the coursework (e-mail, 1/5/00). She primarily used technology for personal tasks at the beginning and ending of coursework; although, she did design, develop, and deliver two lessons with the integration of technology. She additionally planned a HyperStudio stack on colors and shapes that never made it past the storyboard to the computer. No lesson plan or form of evaluation was ever turned in for any of her lessons. During LoUs, she never mentioned speaking about technology to other teachers except for two teachers within the cohort who helped her design and develop the presentation.

According to the Concerns-Based Adoption Model, Sandra’s level of use, as measured by two Level of Use (LoU) interviews, was a Level I (Orientation) for utilization and integration of technology at the beginning of February 2000 and May 2000. Her self-reported minimal computer using proficiency (Integrating Technology in the Schools-A Presurvey, 9/99) supports LoU data. Data collected during AMDT from electronic bulletin board responses, LoU interviews, observations, coursework, and computer logs revealed she was now aware of ways to apply integrated software and other technology tools (Internet) to support instruction. According to the model, Sandra was acquiring information about the innovation and was exploring its value and demands. According to the model, as Sandra becomes more experienced she would be expected to
change her technology use from meeting her needs to meeting the needs of others. According to the model and to researchers referred to in the literature review, Sandra needed additional time to absorb all of the newly acquired technology information and skill. Consequently, through her own accommodation and assimilation, Sandra, was found to be resolving concerns and changing her level of use. Coursework designed with a constructivist approach was found to facilitate Sandra's technology integration. Sandra was also taking a step by enrolling in additional technology coursework (LoU, 5/2/00). Triangulation of other data collected in the presurvey, electronic bulletin board responses, observations logs including video-tape and photographs, and computer logs and other course documentation (course assignments and presentations) supported Sandra’s SoCQ technology concerns and LoU technology usage.

Kathy

With 2 years of kindergarten teaching experience, Kathy initially rated her computer proficiency as a 4 on a scale of 0 (none) to 4 (proficiently) during presurvey (Integrating Technology in the Schools-A Presurvey, 9/99) data collection. She had a home computer which aided in the completion of course assignments and school activities from the start of Introduction to Technology for Teachers (ITT). Internet access was routinely used to correspond with the researcher and to search for school resources. Although used, personal utilization of technology was never logged. Her classroom had two CompStar computers with 266 MHz processors, 32 Mb of RAM, and 2 Gb hard drives. Kathy also had one HP/Vectra 486 with 233 MHz processor and 8 Mb of RAM.
She had one printer and Internet connection. These were all used to support her self-reported 50% learner-centered instruction (Integrating Technology in the Schools-A Presurvey, 9/99).

Kathy was already using technology before IIT (Integrating Technology in the Schools-A Presurvey, 9/99). She used word-processing and desktop-publishing programs to print and enlarge pictures for instructional activity sheets. Kathy’s 20 students were scheduled to rotate in pairs through three classroom computers every morning at the beginning of class. Educational software games (Reader Rabbit Reading, Reader Rabbit Math, Muppet Kids Pre-School and Muppet Kids Kindergarten) were used to reinforce preschool and kindergarten reading and math skills (see Software Review, Appendix R). This schedule typically provided 20 minutes of daily access per student (memo, 3/8/00).

No course expectation was recorded (Integrating Technology in the Schools-A Presurvey, 9/99). During IIT, Kathy learned how to use other technology tools (spreadsheets, databases, and presentations) which she thought she could use to organize class data and design and deliver class instruction.

I am not limited to what other people or texts offer in the way of instruction. I can create papers, pictures, or books to suit my curriculum. I am not satisfied with what I can create by hand. Using computer-generated materials gives the presentation a professional look. The Internet has opened a world of information for me with just a click of a button. I do not have to go anywhere to gather information except my computer. I love using the computer for everything possible. (bulletin board, 3/7/00)

During Software Applications, Teaching Methods, and Software Development for Teachers (AMDT), Kathy assisted her colleagues as they accessed the Internet for additional teaching resources. She was instrumental in identifying websites (FunSchool,
PBS, and CKC Themes) for her colleagues and her own students to use as they began to access the new computer lab.

The article that I read for class had some helpful suggestions for setting boundaries when using the Internet. Teach basic Internet safety rules. Identify appropriate sites and either bookmark or post their URLs to set boundaries. Use search engines designed specifically for children, and organize them into a "search engine folder." Then you can limit your students to these as they explore specific topics you have researched in advance. Consider using a filter—it blocks access to undesirable content, it keeps a log that tracks where children have been on the web, and it puts the skids on what kids can do on-line (such as talking to strangers). Take advantage of the resources that you can find on the Internet—lesson plans, reproducibles, and activities to support curriculum and standards. (bulletin board, 4/4/00)

She evaluated Muppet Kids Kindergarten and Storybook Weaver Deluxe (see Software Review, Appendix R). Both were later integrated into her thematic curriculum.

When I began integrating the computer into my daily classroom routine, I knew the students would have to learn the keyboard. So I had my students type their first/last name (students were learning how to spell their name), type the alphabet (students were learning alphabetical order), type numerals (students were learning to order numerals), and type color words (students were learning how to spell color words). I did not start this computer activity at the beginning of the year because I was not comfortable turning my children “loose,” but next year I will start at the beginning of the school year so that the activities will be a building block of computer knowledge. (bulletin board, 4/4/00)

Kathy, as stated, assisted with the design and delivery of two thematic lessons using PowerPoint and HyperStudio. Both of these were already described in Christy’s case.

I really enjoyed HyperStudio. It was not hard to learn. It provides many options to be integrated into the program. The only trouble that I found was that graphics had to be a particular type. This was very time consuming. I will use this program to develop other theme-related activities. I spent about 3 hours working on this project. My students enjoyed playing the activity and could not wait for a different one on a different theme. Knowing computers enables me to have the courage to try any type of program. If I have trouble with it, I am familiar enough with the computer that I can try different options. (bulletin board, 5/10/00)
It was about 7:30 a.m. on April 11 the first time Kathy and her students were observed, video-taped and photographed by the researcher. "Yellow table, red table, blue table," sounded off from Kathy as two students from each table got up, pushed in their chairs, and hurried to a hanging chart nearby which displayed large, colorful butterflies. Each student found his or her name on a butterfly and picked the name of another student at his or her table to play with on the computer. Shortly two students per computer were playing and learning on the computers. No headphones were used. One student was filling in beginning sounds of words while another was filling in ending sounds using Reader Rabbit. One activity reinforced a skill they were presently working on and the other introduced a skill to be used next week. A third student was working on sorting things by color and shape. The researcher asked, "How long did it take you to get them to this point?"

Actually, when I finally let go, it wasn't so bad--about 3 weeks for them to really get the hang of it once one of them figured it out. Oh, you know, if that screen comes up, we click this. Then they wanted to help each other. I had to tell them to wait to see if they could figure it out first, so they did. It was really neat watching them figure it out, even this one. They had been working on concentration-matching pictures. I knew they were doing that really fast so I moved to beginning sounds where it showed the first letter and the picture. They had to know what the picture was to know what the beginning sound was. They are doing beginning reading. They just figured it out. They just learned that when I started this game they use different keys. They knew. They are smart. They figure things out.

Additionally, the researcher asked, "How do you assess this? Even though it is an instructional type of activity, how do you know they are getting something out of it?"

Well, when we do morning news, they will tell me that they say that over here. I really don't have a formal assessment. The computer doesn't keep track. I would have to sit there with them so I don't keep up with that, but I see it in other applications." When asked if computers have an affect on students, she replied,
"Well, it just extends or reinforces. It gives them another person or another thing to keep up with what they are doing. I can't do that one-on-one like computers can. They really like it.

She also told the researcher that they did not use headphones because she wants to hear what is going on. "So you walk around and monitor?" the researcher asked.

"No, most of the time I would be at one center and they would be working independently."

"This works okay?"

"Yes." Based on what the researcher observed, it did.

During a second observation on May 2, Kathy's students were scheduled to use the computer lab. The computer aid was, as usual, in the lab. The aid had already accessed a site, Billy Bear's Animal Zoo, which Kathy had requested for her students' use. There was no class before Kathy's, so the room was quiet. The atmosphere did not change as they came into the room, single file, quiet. They found seats and waited for directions. Only one had to be guided to a seat.

Okay, look for your name on the paper. Find the word that matches it on the screen. You are not looking at this word. Hold up. Right there. Remember the arrow on the bottom of the screen. Click on it. Look at the pictures. You are looking for a certain animal. What their babies look like, where they live, what they eat. Are you listening?

The researcher noted that one little boy just could not sit still. Others were waiting for assistance, some with hands raised and waving frantically. Soon a few started shouting the teacher's name.

Ms. J's class; stop and look at me. Number one, not all of that talking needs to be going on. If you have a question, do you say "Ms. J?" No. You raise your hand and you wait for me. You do not keep clicking. You raise your hand. Do not call
Ms. J. I think I have figured out what you need. Ms. B (the computer lab aid), the children are looking for the back button.

The computer aid had hidden the toolbar with the back button at the request of another teacher. Now things were back in order, or so it seemed.

Look for where they live. John, stand-up and push your chair in. [This was the boy who could not sit still. He stood behind his chair. Kathy went to another computer to assist a student with her hand up.] Okay. Let me help you find the back button. [Kathy did not mind the children talking about what they found.] Looking for where they live, what they eat, what they play with. Now, John, are you ready to do your job? What are you going to do? Okay. Sit down. [He told her what he had found.] Good, you can tell us this when you get back to the room. Oh, look at this baby. Do they look alike? They do. Does this look alike? What is that? [One student yelled for Ms. J!] He looks dirty. Does he take a bath like you do? Are you supposed to be hollering Ms. J, Ms. J? If you have found what you need to look at and as long as you can tell me something about the animals on your paper, you may look at something else. That is a bad hair day. What do you think John?

The children were settling down, talking to one another, helping one another, smiling, and laughing at pictures. They were learning how to find information on the web. The whole session was structured and managed with an objective to the lesson—finding things that were alike and different. The bell rang. Kathy walked around and told some students to stop clicking so many times. She was constantly assessing, keeping them on task, and asking them questions.

When comparing the researcher’s observation data to Kathy’s self-reported instructional practice, 50% learner-centered, Borich’s (1996) descriptions of student-centered instructional practices (see Observation Log, Appendix K), and descriptors of a constructivist approach (see Appendix Q), Kathy was found to be practicing a student-centered, constructivist approach supported by technology.
According to the Concerns-Based Adoption Model, Kathy’s stages of concerns, as presented in Figure 5, revealed that she had intense self and impact concerns.

Figure 5. Kathy’s stages of concern

ITT and AMDT SoCQs identified an experienced user, resistant to the innovation. Stage 1, 2, 4 and 6 (Informational, Personal, Consequence, and Refocusing) self and impact concerns were most intense during pre-ITT, and Stage 3, 5, and 6 (Management, Collaboration and Refocusing) task and impact concerns were the most intense during post-ITT. Stage 2, 4, and 6 (Personal, Consequence, and Refocusing) self and impact concerns were most intense during pre- and post-AMDT. Stage 0 (Awareness) concerns
were the least intense in *ITT*, and Stage 0, 1, 5 (Awareness, Informational, and Collaboration) concerns were the least intense in *AMDT* SoCQs. According to the model, intense self and impact concerns would be normal, given the fact that she was still learning how to use technology for personal and professional needs. According to other data collected, Kathy had prior use of word-processing and desktop-publishing programs. The SoCQ results alerted the researcher as change facilitator to Kathy's concerns about self and impact. During coursework and interviews, the researcher, as instructor and change facilitator, modeled and facilitated technology tools in a variety of ways—individually, in groups, and through an electronic bulletin board. The researcher applied interventions suggested in the concerns-based model to encourage dialog about technology, incorporate the use of technology in small, sequential steps, and to continue collaborating with others in developing technology activities to support instruction. She applied integrated software to meet her classroom needs by developing, designing, and delivering an instructional lesson supported by technology. She accessed the Internet, evaluated sites, and created her own teacher resource Internet list which her students, and others, accessed in the computer lab. She evaluated educational software and designed two technology activities that supported her instruction. She reflected on technology articles. She reflected on technology questions raised by the researcher and posted responses on an electronic bulletin board. During one interview, Kathy told the researcher that she did not mind working with colleagues but she did mind not being involved in coordinating efforts for group projects (LoU, 5/9/00). This data offers an explanation for the low Stage 5 (Collaboration) impact concerns during *AMDT* SoCQs. According to the
model, as Kathy becomes more experienced she would be expected to change concerns from self to impact concerns. Stage 0 and 1 (Awareness and Informational) self concerns had lessened and Stage 4, 5, and 6 had intensified from September 1999 to May 2000.

The researcher observed Kathy to be very knowledgeable about technology. She had taken a course in WordPerfect and Lotus 7 years ago and from that point learned on her own. "It doesn't come easy. It is not all laid out in the book. A lot of times you don't figure out how to use it until you need it, and then you say, oh, that is how you do it." (Level of Use, 2/4/00) She would assist others if asked. "A lot of times people will call me at home and I go to my computer. This is what I am doing and this is what your screen should say. Well, no it has got to say this" (bulletin board, 2/4/00). When asked if she ever talked to others about technology, she replied, "Oh, yeah, all the time. Anytime there is a question, I'll say I am doing this on the computer. You can try this too. Let me put this on your computer" (bulletin board, 2/4/00). She was not doing a formal evaluation of technology usage, but she was changing the way she used technology. Her classroom technology objectives were "... for my students to become more proficient and take on more responsibility. When we get the computer lab up, that will be so much better because we will all be at the computer at the same time trying to do the same thing. I think that will help" (bulletin board, 2/4/00).

According to the Concerns-Based Adoption Model, Kathy's level of use, as measured by two Level of Use (LoU) interviews, was a Level IVA (Routine) for utilization and integration of technology at the beginning of February 2000 and a Level IVB (Refinement) at the beginning of May 2000. According to the model and other data
collected, Kathy had changed her students' use of technology (drill basic skills) to a variety of uses (drill basic skills, using the Internet to find information, and using interactive multimedia). Her self-reported proficient computer using proficiency (Integrating Technology in the Schools-A Presurvey, 9/99) supports LoU data. AMDT data collected from electronic bulletin board responses, LoU interviews, observations, coursework, and computer logs revealed that her usage of technology was for the purpose of increasing the impact on students. According to the model and to researchers referred to in the literature review, Kathy needed additional time to plan, implement, and evaluate new technology tools to support her classroom instruction; continuous support; and ongoing training to facilitate and sustain technology integration. Kathy was enrolling in additional technology coursework. According to the model, as Kathy refines her use of technology, she would be expected to integrate or combine her efforts with other colleagues to achieve a collective impact. Consequently, through her own accommodation and assimilation, Kathy was found to be resolving concerns and changing her level of use. Coursework designed with a constructivist approach was found to facilitate Kathy's technology integration. Kathy was assisting colleagues with technology development and implementation and enrolling in additional technology coursework (Level of Use, 5/2/00). Triangulation of other data collected in the presurvey, electronic bulletin board responses, observation logs including video-tape and photographs, and computer logs and other course documentation (course assignments and presentations) supported Kathy's SoCQ technology concerns and LoU technology usage.
Sandra Jo

With 7 years of fourth-grade teaching experience (29 years total), Sandra Jo initially rated her computer proficiency as a 1 on a scale of 0 (none) to 4 (proficiently) during presurvey (Integrating Technology in the Schools-A Presurvey, 9/99) data collection. She had a home computer which aided in the completion of course assignments and school activities from the start of Introduction to Technology for Teachers (ITT). Her classroom had four computers. One CompStar computer had a 266 MHz processor, 32 Mb of RAM, and 2 Gb hard drive. Another CompStar had a 200 MHz processor, 32 Mb of RAM, and 2 Gb hard drive. A third computer was an HP/Vectra 486 with 33 MHz. A fourth CompStar computer with 266 MHz, 32 Mb of RAM, and 2 Gb hard drive was on the media cart. These were all used to support her self-reported 50% learner-centered instruction (Integrating Technology in the Schools-A Presurvey, 9/99).

Sandra Jo had limited use of word-processing and computer-assisted instructional software programs before ITT (Integrating Technology in the Schools-A Presurvey, 9/99). Her 26 students were scheduled to rotate through three classroom computers every morning at the beginning of class. Students played 3rd Grade Clue Finders and 4th Grade Clue Finders and used Accelerated Reader to reinforce basic science, math, and language skills (see Software Reviews, Appendix R). Scheduled computer time, along with other “center” time, typically provided each student with 20 minutes of daily access (memo, 3/8/00).

Expectation for ITT was “How to use everything” i.e. word processing, databases, spreadsheets, presentation, multimedia, computer-assisted instruction, and other
During ITT, Sandra Jo learned how to use other technology tools (spreadsheets, databases, and presentations) which she later utilized to support her classroom instruction. Her personal use of technology during Software Applications, Teaching Methods, and Software Development for Teachers (AMDT) averaged 11 hours per week and was primarily for working on course assignments which she later used to support her instruction (Computer Usage Log, 3-5/00).

At the beginning of the course [ITT], I knew enough to use the computer as a typewriter, make cards using a PrintShop disk, and a little of the computer language. I did not know how to save to a floppy or even what “save” and “save as” meant. We have been told we have to use computer technology in the class, and I had no clue what to do or what I could do. I am excited to be able to make charts, use a spreadsheet a little, and use PowerPoint. I have learned a tremendous amount about the many toolbars and their functions. I am eager to use computer technology in the classroom, such as graphs and PowerPoint presentations. (email, 11/8/99)

During AMDT, Sandra Jo accessed the Internet for additional teaching resources. She found AskJeeves, EdWeb, MathGoodies, Math WebQuests, ThinkQuest, FunBrain, NyeLabs, Crayola, Madlibs, and SlylockFox. These were just a few she added to a “hotlist” of websites. She accompanied her students to the new computer lab where they had the opportunity to access some of these sites. Her lessons incorporated the use of SlylockFox and Madlibs websites.

How to structure web projects to engage students in meaningful inquiry is a question hard to address. I am pioneering my way myself, let alone designing a path for others. I can only speak about what I have discovered, so I feel my attempt to design a path for others will be weak. To begin, a teacher must spend time; I have spent hours, finding and then learning how to use websites. Searching the sites you suggested, (especially edweb.sdsu.edu/webquest), plus many more I have discovered, give teachers novel ideas about what to do—make hot links for students, pose questions for students to seek answers; students print information
found; students enter things in a database or spreadsheet; students graph or chart; students make presentations to class. After I experience a lesson with my class, my advice might be altered. (bulletin board, 3/29/00)

On reflection of Madlibs (Activities for Week of March 28, 2000), I am excited to know about the sites for Madlibs. The hurrah.com link will be easy and fun for the students. The enjoyable part will be that there is no incorrect answer. Hopefully, some students will become interested in reading the real stories. The webcomics should be interesting, because students get to create their own nonsense story. The only negative aspect will be the activity will take a long time for one student to complete because so many parts of speech have to be filled in. The webcomics.com/madlib was not as user friendly as the first two. It was not as clear about what to do, and more searching for an activity was required. Thanks for the one-computer-station ideas. I hope to learn of more. (bulletin board, 3/29/00)

Also during AMDT, her students’ experiences extended to usage of Access to enter and sort data and Excel to enter and graph data. She aligned her lessons with math benchmarks on measurement and even created a rubric for evaluation.

I have entered information in one computer in my classroom for my students to experience a database activity. I have entered each student’s name and the following headings: address, age, height, width of hand, length of foot, number of brothers and/or sisters, type of pet, and favorite color. Students will start typing in the known information, measure what is required, and then go back a second time (this will give them additional practice) to type in the measurements. I want to make a query and graph from the information. My greatest weakness is my learning again how to produce the needed activities on the computer. I somehow pushed the list of names on the database down about 10 cells and spent an hour trying to cut and paste them back in place. I looked in Learning Microsoft Office 97 and could not find the help I needed. Then after I completed my response to Question 2, I somehow wiped out my entire response and had to start over. Oh, well, as Kathy said, it takes persistence. Two great strengths to this exercise are the kids will thoroughly enjoy the activity and will be excited over the product they produce. I also want the students to become familiar and comfortable accessing information on the Internet. When the students go to the computer lab this week they will use instructions I have typed for them to find the comic strip SlylockFox. They will interact with the suggested activities and also learn to use the “back” feature. (March 20, 2000)
On April 18, the researcher video-taped and photographed Sandra Jo deliver a lesson in her classroom. When the researcher entered the room, Sandra Jo was seated beside a TV/media cart positioned at the front of the class. Students were seated at tables with sheets of paper and a pencil. She began the lesson by stating, "I want to show you how you can use the computer. You have already seen what this looks like when you entered information into the database. I am going to demonstrate this for you as you tell me what to do and click. When I have demonstrated it a few times, I am going to ask you to come up here and make a query." The researcher observed good use of classroom management. She constantly monitored, questioned, and assessed. "Make sure you stay with me." She had typed instructions with steps to follow as you developed a query. At one point as she looked over the room, she directed them to circle the word query in the title on their page. She watched and waited until all of the students said they were ready. She also knew that they were on the right page. A student was chosen to read the first direction. "Can you see the TV and my mouse moving around?" Students were watching.

Sandra Jo laughed when she realized she was pointing to her monitor and the students could not see. As various students read the steps, the lesson progressed with no problems. "See all the fields we have put in there: name, age, birthday, height, length of hand? Well, we are going to find out who has a birthday in April. No, don't tell us. I don't want to know. We are going to use the database to find the information. This next one is probably the most confusing so listen carefully." As a student read, Sandra Jo had to pronounce column and criteria for him. "I like the way most of you are watching me. What month is April, what number?"
Several students said, “Four.”

“Good, I am going to type in the number 4. Now, I am going to type an asterisk which means I don’t care what year. It is now going to tell me everyone born in April. I have lost what number I’m on?” One of the students told her she was on number 14. “Thank you.” She then called on another student. As he read, she realized that she had a typographical error. “Oh dear, if you would take your pencil and scratch out ‘type’ and put in ‘top.’ Raise your hand if you are through. Would you look at the TV screen please? Look at the toolbox. Read number 15.” She crossed her fingers and said, “Hopefully, it will give me the information I requested. She executed run query. Can you read the names?”

They read from the screen, “Heidi, Kelsey and Travis.”

“Good, were you born in April?” Smiling, they responded, “Yes.” A student came to the front of the class and read the next example. They were going to look for students whose age was only one digit. Her example said that these students would get in an ice hockey game for free. She had to caution students not to read their paper copy of the database, “Excuse me; we are going to use this. Here is the question again in case you have forgotten. Which field am I looking for to include in the query? Listen.” A teacher came to the door. Sandra Jo asked if she could help her later. “I have a college teacher here.” In no time the lesson was back on track. “Less than what?”

“Ten,” the class responded.

“What is the less-than sign?” Sandra Jo entered the sign and the number 9.

One student said, “No, less than 10.”
“Very good.” As the results popped up on the screen, Sandra Jo requested, “All of you that get in free, will you stand up? Okay, good, now have a seat please.” As a different student went to the front to read the next problem, another teacher came to the door to get a student out of the class. [The researcher was amazed that the flow of instruction did not stop for more than a second]. “Oh good, some of you are awake. This is the hardest one. Now, I am going to use one of these again. What do I do? I want to know who is 5 feet or taller. “I know,” said one student. “Use the greater sign.”

“Good.” When the query was complete, Sandra Jo sadly reported, “Sorry, the rest of you do not get to go on the ride because you are not taller than five feet. One student started to ask Sandra Jo something that the researcher could not hear and she quickly replied, “We will talk about that later. Have a seat. Thank you very much. Number 3.” A third student went to the front of the class to read another problem. Sandra Jo asked the students to listen very closely. “What do I have to do? What do I click?” Students would respond at random. “What do I do now? What is that hard word we learned today? Would you say that please? Again. Let me hear everyone say ‘criteria.’ This tells me it is a great big fat word that says, ‘tell me what you want to find.’ What do you think I need to enter? Let me see your hand if you know. Less than one? Zero? Who knows next?” The students told her “query” and then “run.” “Look, only two students do not have a pet. What? James is not on there. Uh oh, we will have to go back and add him. Would you three come up here? Crystal, you come up here and type. You will need your sheet. I like the way most of you are watching. I want to put you right here and you right here.” The students were ready for their turn at the front of the class. One student typed, while the other two
assisted. As one student pointed to the screen to help, Crystal typed in the correct
information. Sandra Jo asked, "Where does the criteria go?" The student pointed to the
TV screen. "Very good." The lesson, Sandra Jo's second to integrate technology to
support her classroom instruction, appeared to the researcher to be effective.

On May 2, the researcher returned to video-tape and photograph the second part
of the lesson which involved integrating technology to graph data from a query. Sandra
Jo still had the TV/media cart at the front of the room, but the TV was not facing the
students. Three students were selected to go to the front of the class to create and print a
graph in Excel using information from a database query. As they gathered around the
computer, Sandra Jo left to help a student doing seatwork. She came back to the computer
and asked, "Have you entered the numbers yet?" She got them started and left again. She
walked around to different tables to check on the progress of the other students. Suddenly,
the students hit print by accident. They all looked at the researcher as if they had
committed a crime. They were reassured that it was okay as Sandra Jo came back to the
front. "Okay, go up one more. Let go of this and use this. Do you need to go in? Let me
see. Do you need to go into this cell? Use your arrow. Go up one. Okay. No, we aren't
ready for a graph. This says type in your numbers. Have you tallied or counted them yet?"

They responded, "No."

The class was getting a little noisier. Two looked up the data needed while one
waited to type. After the data were entered, they were unable to follow the instructions on
creating a chart. They could not find the chart wizard. Sandra Jo appeared again and
helped them locate the chart wizard. "Hold it down. Click on bar. See how your chart
changes? That is the way the data will look. Look at a pie one. What does it look like? That is pretty easy to read too, isn’t it?” She turned around to observe the rest of the class as the printer churned out the completed graph. Shortly, she announced to the class, “When you get to number 16, you will need your number line. Order them from smallest to greatest.” The students at the computer waited for the graph to print. The researcher observed that they loved the colors on the graph and were all smiles as they returned to their seats.

As another group came to the front, an announcement over the loud speaker blared, “Do you want [the principal] to see him?

Sandra Jo said, “Yes, M’am.”

Again the announcement, “What was he doing?”

Sandra Jo never looked up as she said, “He was disturbing the class.”

The researcher observed that this lesson proved to be a little harder for the students. Unless one student really knew what to do, they appeared to be lost. Even with the directions, they appeared to be confused. The integrated lesson and activities were well planned and designed. Sandra Jo’s rubric included (a) working cooperatively in a group, (b) displaying accurate information, (c) displaying information in an interesting and neat way, and (d) working quietly while others were at the computer. This was not the first time the students had been through the lesson. They were doing it a second time so the researcher could observe. However, as researchers referred to in the literature have found, it takes time. Within 2 months, Sandra Jo had changed her instructional practices to incorporate the use of technology to support her classroom instruction.
Technology has made me go back to school to learn to keep up with my students and to stay ahead of my students. I must learn to challenge my students and help them develop higher-order thinking skills. I feel it is part of my job to teach students how to use the Internet, spreadsheets, word processor, etc. I am enjoying learning this new technology, but it is hard and time consuming. If I don't use it often, I tend to forget the minute details. (bulletin board, 3/7/00)

I reluctantly signed up for the computer courses because I knew nothing. I knew I had to learn because the new teaching standards were demanding students become computer literate, and I had to be comfortable with computers before I could help others. Plus, I wanted to learn just for myself. I am elated over the knowledge I have acquired. Not only am I using my newly acquired skills in the classroom, but the skills are helping me with many other activities in which I am involved. Thank you for your encouragement and constantly telling us we can do the work. Your flexibility helps relieve a lot of stress. (bulletin board, 5/6/00)

When comparing the researcher's observation data to Sandra Jo's self-reported instructional practice, 50% learner-centered, Borich's (1996) descriptions of student-centered instructional practices (see Observation Log, Appendix K), and descriptors of a constructivist approach (see Appendix Q), Sandra Jo was found to be practicing a student-centered, constructivist approach supported by technology.

According to the Concerns-Based Adoption Model, Sandra Jo's stages of concerns, as presented in Figure 6, revealed that she had intense self, task, and impact concerns.

ITT and AMDT SoCQs identified an inexperienced user, resistant to the innovation in November 1999, March 2000, and May 2000. Stage 0 and 3 (Awareness and Management) self and task concerns were the most intense during pre-ITT, and Stage 1, 2, and 3 (Informational, Personal and Management) self and task concerns were the most intense during post-ITT. Stage 1, 2, 3, and 6 (Informational, Personal, Management, and Refocusing) self, task, and impact concerns were the most intense during pre-AMDT, and
Stage 2, 3, and 6 (Personal, Management, and Refocusing) self, task, and impact concerns were the most intense during post-AMDT. Stage 4 and 6 (Consequence and Refocusing) concerns were the least intense in ITT, and Stage 0 and 4 (Awareness and Consequence) concerns were the least intense in AMDT. According to the model, intense self, task, and impact concerns would be normal, given the fact that she was still learning how to use technology for personal and professional needs. According to other data collected during AMDT, Sandra Jo had limited use of word-processing. The SoCQ results alerted the researcher as change facilitator to Sandra Jo's concerns about self, task, and impact. During coursework and interviews, the researcher, as instructor and change facilitator,
modeled and facilitated technology tools in a variety of ways—individually, in groups, and through an electronic bulletin board. The researcher applied interventions suggested in the concerns-based model to encourage Sandra Jo to continue communicating with others who know about technology, incorporating technology in small, sequential steps, and collaborating with others in developing technology activities to support instruction. The ongoing, sustained coursework enabled Sandra Jo to engage in learning activities in which she could construct her own knowledge about technology integration and could resolve her self concerns. She applied integrated software to meet her classroom needs by developing, designing, and delivering instructional lessons supported by technology. She accessed the Internet, evaluated sites, and created her own teacher resource Internet list which her students accessed while in the computer lab. She evaluated educational software for classroom use. She reflected on technology articles. She reflected on technology questions raised by the researcher and posted responses on an electronic bulletin board. According to the model, as Sandra Jo becomes more experienced she would be expected to change concerns from self and task to impact concerns. Stage 0 (Awareness) self concern had lessened and Stage 1, 2, 3, 4, 5, and 6 had intensified from September 1999 to May 2000. Sandra Jo reported to enjoy learning technology. “Oh, I just love the technology. I learned vocabulary and how to use a lot of what was in my computer. It just amazed me to discover what was there for me, and so much more is there that I can learn about and use” (Level of Use, 2/4/00). Throughout the coursework, she sought information which she used to design and deliver three technology integrated lessons. “My students used Access to enter information in a database, to run a query, and to use
the same information to make a graph from Excel. They liked getting to type their personal information and they especially enjoyed producing a graph. I will do this program again next year. I also want to incorporate science programs” (bulletin board, 5/6/00). When asked what her needs were regarding technology information, she replied, “Time to do it. Right now I am just keeping my head above water. With all of my other responsibilities that I have here, I don’t have time to explore the way I want to. There is so much that I could use. The advantage of taking a class is that I have to do it, and I am guided in what I can do” (Level of Use, 2/4/00). When asked if she talked to others at the school about technology, she revealed, “Some are excited; those that know the vocabulary and how to use it. Those that freeze, I think they will eventually come around. I have seen it just this year. They have softened up and realized that it is not a bear” (Level of Use, 2/4/00).

According to the Concerns-Based Adoption Model, Sandra Jo’s level of use, as measured by two Level of Use (LoU) interviews, was a Level I (Orientation) for utilization and integration at the beginning of February 2000 and a Level III (Mechanical) at the beginning of May 2000. According to the model and other data collected, Sandra Jo had limited personal use of technology. Her self-reported minimal computer using proficiency (Integrating Technology in the Schools—A Presurvey, 9/99) supports LoU data. Data collected during AMDT from electronic bulletin board responses, LoU interviews, observations, coursework, and computer logs revealed that her usage of technology was for learning how to use technology for herself and for her students. According to the model, as Sandra becomes more experienced she would be expected to change her
technology use from meeting her needs to meeting the needs of others. According to the model and to researchers referred to in the literature review, Sandra Jo needed additional time to absorb all of the newly acquired technology information and skill. Consequently, through her own accommodation and assimilation, Sandra Jo was found to be resolving concerns and changing her level of use. Coursework designed with a constructivist approach was found to facilitate Sandra Jo’s technology integration. Sandra Jo was applying new technology information to impact students, continuing to share her new skills with colleagues, and enrolling in additional technology coursework (LoU, 5/1/00).

Triangulation of other data collected in the presurvey, electronic bulletin board responses, observations logs including video-tape and photographs, and computer logs and other course documentation (course assignments and presentations) supported Sandra Jo’s SoCQ technology concerns and LoU technology usage.

**Claudia**

With 12 years of elementary special education teaching experience, Claudia initially rated her computer proficiency as a 1 on a scale of 0 (none) to 4 (proficiently) during presurvey (Integrating Technology in the Schools—A Presurvey, 9/99) data collection. She purchased a home computer and Internet service in November 1999 near the end of the first course, *Introduction to Technology for Teachers (ITT)*.

Her classroom had three computers. One Compaq had 266 MHz, 32 Mb of RAM, and 2 Gb hard drive. Two Magnavox had 166 MHz, 32 Mb of RAM, and 2 Gb hard drive. These computers were used to support her self-reported 50% learner-centered instruction (Integrating Technology in the Schools—A Presurvey, 9/99). There was no Internet
connection in her classroom. She had two full-time resource aids that accompanied students when they attended regular classes.

Claudia had limited use of word processing before ITT. “Before that class, I had almost no experience with any of these tools (Word, Excel, Access, and PowerPoint) other than a quick exposure in a course several years ago” (bulletin board, 4/4/00). Claudia primarily used the Compaq, with a printer, for IEP’s. Her class, kindergarten and first-grade developmental resource, had three students that used educational games (Magic School Bus Explores Bugs, Reader Rabbit Kindergarten, Disney’s Toy Story and Arthur’s First Grade) daily for 30 minutes to reinforce kindergarten and first-grade skills (see Software Reviews, Appendix R). Claudia worked with them one-on-one. “We were given computers and software for the children to use several years ago, and I have been using them since that time” (Level of Use, 3/7/00).

Her personal use of technology, as documented in her computer logs during Software Applications, Teaching Methods, and Software Development for Teachers (AMDT), averaged 3 hours per week and was primarily for working on course assignments which were used to support her instruction.

At first I was using the computer at school or class. Things got much better when I got my home computer. I think you need a computer at home to do all the lessons we had to do. I think teachers who take this class have to have time in their schedule to get all the lessons done. It has taken lots of time in my case, an hour per lesson, but I was pretty slow at first. (e-mail, 11/4/99)

Her expectation for the course was “to learn all the new technology that has come out for computers in teaching, since it has been several years since I took a course” (Integrating Technology in the Schools-A Presurvey, 9/99). During ITT, Claudia learned
how to use other technology tools (spreadsheets, databases, and presentations), which she later used to design and deliver classroom instruction. "I am using my [home] computer more every day and starting to enjoy it as I get better at this! I have been writing home to parents and did a memo yesterday" (e-mail, 11/4/99). Her personal use later extended into the classroom.

Technology has opened up areas that were not there for me before. The information you can gain for use as a teacher is endless. The computer had been great for writing IEP's. It was a timesaving tool, but I have learned so much valuable information by taking these technology classes. I feel more at ease using a computer" (bulletin board, 3/7/00).

During AMDT, Claudia accessed the Internet in the computer lab for additional teaching resources. She reported especially enjoying Connecting Students Through Themes and Units (www.teleport.com), which had themes and units in all subject areas. Her statements about using curriculum first and technology second clearly reflected one of the course objectives. It also described a constructivist approach.

I think teachers have to use the content standards for a particular subject and build the lesson from there. You can use all of the regular resources that you would use in the classroom and then start adding all of the great ideas you can find on the web. There seem to be many possibilities with all the information that is out there now. I would start with a topic or learning goal then assemble various resources such as an Internet hotlist and hope to achieve learning by building knowledge and using Webquests for problem solving. This would have to take place in a lab because I do not have the Internet in my classroom. As I have a class of developmentally delayed children, assistance would be necessary to help them achieve the goals of the lesson. (bulletin board, 3/27/00).

She evaluated educational software (Arthur's 1st Grade and Read, Write and Type!) that she had available at school and through the researcher (see Software Reviews, Appendix R). Although Arthur's 1st Grade had been available at the school, Claudia never took the time to evaluate it before the class assignment.
Claudia designed, with the assistance of Kim and another course participant, one thematic lesson using PowerPoint. Using her classroom computer, Claudia developed slides used in the presentation.

My class is learning about insects. I will develop a unit that includes various uses of technology. My first-grade student will work with me at the computer developing a PowerPoint presentation about the caterpillar and the ladybug. We will work together to come up with text and graphics for each of the insects. These will be used to make a book about insects along with my partners in class. We will combine all of our pages into one book. This book can be used as a picture book for the K students. The first-grade student can read to them from the book. The students can then take turns at the computer using a software program about bugs and their habitats. This will serve to introduce them to insects and provide an ongoing learning center throughout our unit. I worked with my student at the computer to create some PowerPoint pages. He loves to work with me. He was using the keyboard and the mouse independently and seems to understand what we are creating. Weakness were (a) some students were not familiar with the use of the mouse and needed peer or adult help, and (b) there was no Internet connection in my classroom at this time to extend the lesson. The strength was that students will learn needed computer skills along with content standard lessons. (bulletin board, March 19, 2000)

Claudia was observed by the researcher on April 18. Her lesson plan referenced curriculum framework and was supported by technology. The first objective—use PowerPoint to make a book about insects—was modified to one about spiders. The second objective—compare and contrast insects and spiders—was not met during this observation. However, it should be noted that the lesson was planned for three days and this was day one. The presentation was later delivered in Kim’s classroom as described earlier in her case.

As her student entered the room, Claudia directed him to come to the computer at the center to continue his science lesson on insects. “How many body parts does an insect have?” There was no response. “How many legs does a spider have?”
Appearing distracted, he replied, "It is called an arachnid."

"Yes." Claudia was trying to get his attention, "Okay let us go to the computer."

He did not want to. "I am sorry, but I want to go to the table and connect the dots."

Claudia complied with his request and retrieved a worksheet with dots forming the shape of a spider. "Can I color it too? I want to color. Please? I want to color him and cut him out."

Giving him time to connect the dots, Claudia said, "We are going to make our book first."

"Okay," he replied, as he continued to focus on his sheet.

Claudia again asked, "How many body parts?"

He was still intent on finishing his work, "I want to put in her eyes. One, two, three, four, five, six."

Claudia corrected, "Those are legs. How many body parts?"

"Three; she is an arachnid, so it would be eight," he finally said.

"Legs, but how many body parts?" Claudia again corrected.

Thinking, he replied, "It is an arachnid, so three. Can I read now?"

Claudia motioned to the computer, "Not now, let's go to my computer."

That did the trick, "Okay, I love this computer." He was eager to get his hands on the keyboard. Claudia asked him to wait. He insisted, "I know how to do this. [Go to] Programs."

Claudia followed his directions and opened PowerPoint. They started on the first slide.
He certainly knew how to use the program. “No, click to add clipart. Add a picture of a spider. She [my mother] won’t mind, right?”

Claudia asked, “Information first or a picture first?”

“Picture first,” he declared. “Look on the last one Ms. S.”

While they worked as a team, Claudia said, “Tell me something about the spider?”

“It has eight legs,” he announced.

“Good,” said Claudia, “so put it has eight legs.” He entered the text into PowerPoint on his own. He spelled out the words on his own. Claudia watched his hands as he typed. He clapped his hands after he finished entering his data. With Claudia’s assistance, he added clipart of a spider.

The evaluation for the lesson was a finished PowerPoint book which, again being day one of the lesson, was not achieved during this observation. He was, however, able to answer questions about arachnids and to use this information to enter three facts about a spider on the slide.

When comparing the researcher’s observation data to Claudia’s self-reported instructional practice, 50% learner-centered, Borich’s (1996) descriptions of instructional practices (see Observation Log, Appendix K), and descriptors of a constructivist approach (see Appendix Q), Claudia was found to be practicing a student-centered, constructivist approach supported by technology.

Claudia developed and designed, with the assistance of Kim and another class participant, a HyperStudio stack on dinosaurs. This was also described in Kim’s case. Claudia had the following to say about her experiences with PowerPoint and HyperStudio.
I like the idea of HyperStudio. I think the interaction between computer and student is a great idea. There are so many uses for this. I do not think it is very user friendly though. I did not like the way the screen went black when I tried to save HyperStudio. Also, the clipart was very hard to use. Another problem was access to a computer with HyperStudio on it. The lab is not open after hours and there is no time during the school day. I hope to install it in my classroom so I can use it. Because we did our presentation as a group, my part of the presentation preparation was probably about two hours. PowerPoint is easy to use. I think our presentation went well. The class seemed to enjoy the insect book and joined in the discussion. (bulletin board, May 7, 2000)

According to the Concerns-Based Adoption Model, Claudia's stages of concerns, as presented in Figure 7, revealed that she had intense self and task concerns.

![Graph showing Claudia's stages of concern](image-url)

**Figure 7. Claudia's stages of concern**
ITT and post-AMDT SoCQs identified an inexperienced user, resistant to the innovation in September 1999. Stage 0, 1, 2, and 3 (Informational, Personal, and Management) self and task concerns were the most intense during ITT and AMDT. Stage 4 and 5 (Consequence and Collaboration) impact concerns were the least intense during ITT and AMDT. According to the model, intense self and task concerns would be normal given the fact that she was still learning how to use technology for personal and professional needs. According to other data collected, Claudia had limited use of word-processing prior to ITT (Integrating Technology in the Schools-A Presurvey, 9/99). The SoCQ results alerted the researcher as change facilitator to Claudia’s concerns about technology. During coursework, the researcher, as instructor and change facilitator, modeled and facilitated a variety of collaborative activities supported by technology. The researcher applied interventions suggested in the concerns-based model to encourage a dialog about technology, incorporate the use of technology in small, sequential steps, and to continue collaborating with others in developing technology activities to support instruction. The ongoing, sustained coursework enabled Claudia to engage in active learning activities to construct her own knowledge about technology integration and could resolve her self concerns. She cooperatively planned, developed, designed, and delivered classroom activities supported by technology. She reflected on technology articles. She also reflected on technology questions raised by the researcher and posted responses on an electronic bulletin board. According to the model, as Claudia becomes more experienced and successfully resolves her concerns, she would be expected to change
concerns from self and task to impact concerns. Stage 0, 1, 2 and 3 concerns have lessened between September 1999 and May 2000, while Stage 5 has intensified.

Throughout the coursework, Claudia’s requirement for curriculum first and technology second matched the researcher’s perspective. Although an inexperienced technology user, her use examined personal, student, and colleague impact. “I know I have a long way to go to be able to do this well, but the more I use the computer, the more comfortable I become” (bulletin board, 4/4/00). Later she commented, “I didn’t even own a computer until the first class started. Now I can teach with a computer!” (bulletin board, 5/7/00). When asked how she informed other teachers about her experiences with the use of technology, she replied, “I think word of mouth is the main way I inform other teachers of anything I learn. I also show articles and information to them from the Internet” (bulletin board, 3/15/00).

This class and others like it will be a great asset to teachers. They just need to take advantage of these classes when they are offered. I think there are still teachers that have no idea at all how to use a computer in any way, much less as a teaching tool. (4/4/00)

She was concerned about the impact of technology on her students when she stated, “I hope my students will start benefitting from technology soon. I do not have the Internet in my classroom, but they can attend the computer lab with their homeroom class” (bulletin board, 3/15/00).

According to the Concerns-Based Adoption Model, Claudia’s level of use, as measured by two Level of Use (LoU) interviews, was a Level II (Preparation) for utilization and integration of technology at the beginning of March 2000 and a Level III (Mechanical) at the beginning of May 2000. According to Claudia, she was just beginning
to use technology for her personal needs in November 1999. Her self-reported minimal computer using proficiency (Integrating Technology in the Schools-A Presurvey, 9/99) supports LoU data. However, after AMDT, data collected in bulletin board responses, LoU interviews, observations, and computer logs revealed that she was now aware of ways to apply integrated software and other (HyperStudio; Read, Write, & Type!; and Storybook Weaver) technology tools to support instruction. Claudia was found to be focusing on the short-term, day-to-day use of technology with little time for reflection. Changes in use were made more to meet her needs than her student needs. She was primarily engaged in a stepwise attempt to master the tasks required to use technology. According to the model and to researchers referred to in the literature review, Claudia needed additional time to plan, implement, and evaluate new technology tools to support her classroom instruction; continuous support; and ongoing training to facilitate and sustain technology utilization and integration. Consequently, through her own accommodation and assimilation, Claudia was found to be resolving concerns and changing her level of use. Coursework designed with a constructivist approach was found to facilitate her technology integration. Claudia was resolving self- and task-concerns about technology and applying new information to impact students, sharing her newly acquired skills with colleagues, and enrolling in additional technology coursework (Level of Use, 3/7/00 and 5/1/00). Triangulation of other data collected in electronic bulletin board responses, observations logs including video-tape and photographs, computer logs, and other course documentation (course assignments and presentations) supported Claudia's SoCQ technology concerns and LoU technology usage.
Deric

With 4 years of special education teaching experience, Deric initially rated his computer proficiency as a 2 on a scale of 0 (none) to 4 (proficiently) during presurvey (Integrating Technology in the Schools—A Presurvey, 9/99) data collection. "When I took the first part [an Introduction to Technology for Teachers (ITT)], I did not have access to a computer and my interest was not high" (response to bulletin board, 5/7/00). However, Deric did have an Apple iMac computer with 333 MHz, 32 Mb of RAM and 6 Gb hard drive in his classroom. It remained unopened in a box throughout the coursework. The school system Title I Supervisor awarded a 400 MHz, 64 Mb of RAM and 6.4 Gb hard drive Compaq computer to Deric after completing ITT. "I received a computer in December and my interest level has increased ever since" (response to bulletin board, 5/7/00). This computer was installed in January 2000; however, it did not have a printer.

No course expectation was recorded during ITT (Integrating Technology in the Schools—A Presurvey, 9/99). During ITT, Deric learned how to use and apply integrated software. After ITT, he reported using technology for "what I learned in class" and to "make lesson plans and play games" (Level of Use, 2/7/00). During Software Applications, Teaching Methods, and Software Development for Teachers (AMDT) his personal use of technology averaged 4 hours per week and was primarily for accessing sport websites, working on course assignments, and creating a Mother's Day card using Print Artist (Computer Usage Logs, 3-5/00). He expressed that "It [technology] has been quite an experience because it [technology] is constantly changing and there is [always] something to learn," as described below. In April, Deric purchased a home computer,
scanner, printer, and digital camera; and he reported his technology use as "really exploding" (response to bulletin board, 5/7/00).

I learned how to create and print documents. I learned how to create, save, and print a presentation using PowerPoint. I also learned how to open and edit documents. I have not had a chance to use this new technology with my students. I only have one computer. I installed my computer in January and I have not had time to go through all of the details about PowerPoint with them. I have about five students who use the Internet. These students look forward to going on-line every day. Their favorite sites are CBS Sports Line, ESPN, NBC Sports, and KTBS. I would be happy if I could give one of my students a topic and they could look up the topic on the Internet; however, most of my students are on the fourth-grade reading level. (response to bulletin board, 4/12/00)

An Internet connection was available in his classroom by the end of March. He began using two free e-mail accounts from two different providers, although several attempts by the researcher to correspond via e-mail and electronic bulletin board failed. In fact, the only correspondence conceded, "I am sorry, Mrs. B. I have been answering the questions but I have not sent them to you. I have been saving them on the disk. I will send them to you Mrs. B. I am sorry for not checking my e-mail" (e-mail, 4/10/00). The researcher never received another e-mail or posted bulletin board response.

Internet searches were for sport (Internet resource list, 4/4/00). At the researcher's request, he was encouraged to develop another list focusing on his area of instruction. This list identified American, Women's, African, and Military History sites and proved useful in locating pictures of weapons used in World War II (WWII) which were incorporated in a PowerPoint presentation for whole-class instruction.

When the researcher asked if he collaborated with others in his cohort when developing and designing his instructional lesson, he replied, "We did not do any activity as a group" (response to bulletin board, 4/12/00). In planning for the lesson, Deric
explained, “My students can use the computer as an encyclopedia and look up a website of their choice. I will be reviewing WWII for the next couple of weeks, so I will set up an activity dealing with what happened during WWII” (response to bulletin board, 4/12/00). Once developed, the objectives of the lesson were “to give the students a better understanding of WWII, to show them what kind of weapons they used, and to tell them how the atomic bomb changed the view of the war.” He stated, “The students will know the major battles of the war” (lesson plan, 4/26/00).

On April 26, when the researcher entered Deric’s room for an observation, he was standing by his classroom computer. One student was sitting at the computer with his back facing the class, and six students were slouched at their desks. A full-time paraprofessional was seated at a corner desk and appeared to be looking at papers. Deric had printed the presentation slides containing the black and white images of WWII weapons on paper with a birthday party border (yellow, red and blue balloons, party hats, and streamers). The images were distorted; two were unrecognizable. These were placed on student’s desks. There was no introduction to the lesson (the researcher may have missed it), as he explained what he was doing. “They look for information and then save it on the disk.” The student at the computer attempted to save something to the disk while the students at their seats remained motionless. “The information from this disk will be copied and they will take it home to summarize.” Five minutes passed with no instruction. Deric was concentrating on the computer activity and students were looking around, scratching their heads. A student entered the room and approached Deric. Never taking his eyes off the computer, he directed the student to return to her room, “Go to class; go
to class." The student left of her own accord, and Deric continued to stare at the computer. "Okay, he is going to save this to a disk." Students stretched. Deric finally abandoned the computer. "We have been working on Franklin D. Roosevelt. They know that FDR is responsible for social security and a bunch of other things. They know that Harry Truman took over when FDR died. They know that he was president for 13 years. Right, guys?" There was no response. Deric continued, "WWII was the turning point for how things would shape up for the U.S. Who was that dictator? From Germany? Nazi leader?"

"I forgot," one student answered.

An announcement from the loud speaker interrupted Deric. "We are going to work on that the rest of the week." Someone else came in the room to ask Deric a question, but it appeared to have no influence on anyone in the room. Students appeared comatose as Deric proceeded with his lesson. "The rest of them went to the computer yesterday, this student [pointing to the student at the computer] was absent yesterday. Bring a disk tomorrow and I will print it out for you, okay?" The student acknowledged by shaking his head. Deric advised the researcher that he had completed his lesson. The student activity, according to the lesson plan, was to "use the computer to look up information about the war and weapons using Alta Vista and Searchopolis"; but it was not observed.

When comparing the researcher’s observation data to Borich’s (1996) descriptions of instructional practices (see Observation Log, Appendix K) and descriptors of a constructivist approach (see Appendix Q), Deric was found to be practicing a teacher-centered, direct instructional approach. Neither a constructivist approach nor a lesson supported by technology was observed.
Later, Deric created a HyperStudio stack on Africa, which was an activity outlined in the course syllabus. He reported, "My experience with HyperStudio was wonderful. We worked through lesson 6. We designed four buttons ranging from Africa to animals in the jungle and imported a picture from a digital camera" (response to bulletin board, 5/7/00). The researcher as instructor noted that there was no evidence of planning for instructional objectives, instructional activities, or evaluation. Additionally, his stack was identical to those submitted by two other course participants.

According to the Concerns-Based Adoption Model, Deric's stages of concern, as presented in Figure 8, revealed that he had intense self and impact concerns.

![Figure 8. Deric's stages of concern](image-url)
ITT and AMDT SoCQs identified an inexperienced user. Stage 0, 1, 2 (Awareness, Informational, and Personal) self concerns were most intense during ITT, and Stage 1, 2, 4, 5, and 6 (Informational, Personal, Consequence, Collaboration, and Refocusing) self and impact concerns were the most intense during AMDT. Stage 4 and 6 (Consequence and Refocusing) were the least intense during ITT, and Stage 0, 3, and 4 (Awareness, Management, and Consequence) self, task, and impact concerns were the least intense during AMDT. According to the model, intense self and task concerns would be normal given the fact that he was still learning how to use technology for personal and professional needs. According to other data collected, Deric had limited use of technology prior to ITT (Integrating Technology in the Schools-A Presurvey, 9/99). The SoCQ results alerted the researcher as change facilitator to Deric's specific needs required to resolve his concerns about technology. During the coursework, the researcher, as instructor, modeled and facilitated a variety of individual and collaborative activities supported by technology. The ongoing, sustained coursework enabled Deric to engage in active learning activities to construct his own knowledge about technology integration. He planned, developed, and delivered a lesson, but there was no evidence of a constructivist approach to classroom instruction or activities. There was also no evidence of integrating technology to support instruction. He did not reflect on a technology article; he copied an article from the Internet and turned it in. He did not reflect on technology questions raised by the researcher as instructor during AMDT; he answered the questions at the end of the course with brief sentences containing no substance. Therefore, he provided the researcher with no data to determine if he internalized, restructured, and transformed new information. At
the same time, the researcher as change facilitator applied interventions (see Stages of Concern and Interventions to Facilitate Change, Appendix E) which informed him about technology in a variety of ways, provided practical assistance, fostered collaboration with others in developing technology activities to support instruction, and encouraged the use of technology in small, sequential steps. Deric was still in the early stages of change. He was still in the process of learning how to integrate technology into the classroom. With additional time for Deric to successfully resolve self and task concerns, he would be expected to move to impact concerns.

Throughout the coursework, Deric’s interest in using technology was personal as reflected in his statements “making lesson plans, playing games” (Level of Use, 2/7/00). When asked which integrated software—word processing, a database, spreadsheet, or presentation—from ITT that he was using the most, Deric replied, “Spreadsheet.”

The researcher then asked, “What are you using it for?”

Deric did not know, “I just said spreadsheet” (Level of Use, 2/7/00). Further probing revealed that he was using word processing exclusively. Later usage included PowerPoint and the Internet. He reported that his knowledge about technology had changed, “I didn’t know anything [before the course]” (Level of Use, 2/7/00). When asked if he was talking to others outside of his cohort about technology, he replied, “No” (Level of Use, 2/7/00). He had no plans for changing his teaching practices next year to include technology when interviewed in February; however, in April he discussed using the Internet.
According to the Concerns-Based Adoption Model, Deric's level of use, as measured by two Level of Use (LoU) interviews, was a Level 0 (Nonuse) for utilization and integration of technology at the beginning of February and a Level I (Orientation) at the beginning of May 2000. According to Deric, he was not interested in technology until December 1999. His self-reported comfortable computer using proficiency (Integrating Technology in the Schools-A Presurvey, 9/99) did not support LoU data. Data collected in bulletin board responses which he never posted, LoU interviews, observations, and computer logs revealed that he was not aware of how to apply integrated software and other technology tools (HyperStudio, Internet) to support instruction. According to the model, Deric was still acquiring information about technology and exploring its value. According to the model and to researchers referred to in the literature review, Deric needed additional time to plan, implement, and evaluate new technology tools for himself; continuous support; and ongoing training to facilitate and sustain technology utilization and integration. Consequently, through her own accommodation and assimilation, Deric was not found to be resolving concerns and changing his level of use. Coursework designed with a constructivist approach was not found to facilitate his technology integration. He reported that he was still familiarizing himself with technology and had no immediate plans to enroll in technology coursework (Level of Use, 5/11/00).

**Rita**

With 21 years of eighth-grade language arts teaching experience (26 years total), Rita initially rated her computer proficiency as a 1 on a scale of 0 (none) to 4 (proficiently) during presurvey (Integrating Technology in the Schools-A Presurvey, 9/99)
data collection. Although, she reported using word processing either at home or at school (Integrating Technology in the Schools-A Presurvey, 9/99), Rita had limited use of word processing before an Introduction to Technology for Teachers (ITT). She also had limited involvement in several Plato workshops before ITT and commented, “But it was too much too quickly and once they were gone and I didn’t have anyone to answer questions; it was hard” (Level of Use, 2/7/00). Her expectation for the course was: “I would like to learn how to use the computer to help me and to be able to teach a computer class” (Integrating Technology in the Schools-A Presurvey, 9/99).

Her classroom had two Compaq classroom computers with 233 MHz, 32 Mb of RAM, and 2 Gb hard drives to support her self-reported 50% learner-centered instruction (Integrating Technology in the Schools-A Presurvey, 9/99). She had a printer and two Internet connections. Her students used the computers 5 to 10 minutes per day to take tests on the Accelerated Reader program (see Software Reviews, Appendix R).

Rita described her experience in ITT as a positive one.

Well, working at my own speed, your explaining and demonstrating something to us and then getting to do it. If I had a problem, you were right there or somebody in the room could help. It made a difference. (Level of Use, 2/7/00)

She felt the strength of the course was “the variety of information that was presented, things that were actually usable. We were given things that before I would have said, ‘Okay, when am I ever going to use that,’ but these were things that I could use and the kids could use—shortcuts” (Level of Use, 2/7/00).

As a student I was always fascinated by the means available at the time. For instance, the film strip projector or the film projector were used when I was in elementary and high school. I am very much a visual learner, so I felt like I was really getting the point the teacher was trying to make! As a teacher, I guess I've
used all of the technology that has been made available to me. Sometimes I'm a slow learner. I really have to be shown how technology is going to benefit my students and me! I just started using the overhead in the last two years. I've always used the chalkboard. I make use of a tape player, a CD player, a TV, a VCR, and the computer. I do not use them just for the sake of using technology, but because I feel they will enhance my students' learning. (bulletin board, 3/8/00)

Her perspective matched the researcher's perspective: "Do not use technology just for sake of using technology; use it to support instruction."

Her personal use of technology during *Software Applications, Teaching Methods, and Software Development for Teachers (AMDT)* averaged 5 hours per week and was primarily for working on course assignments which were used to support her instruction (Computer Usage Logs, 3-5/00). However, she felt she was not using technology enough to support instruction. "[Technology] just has not presented itself in such a way that I have been able to use it other than for accelerated reading. So I am using that" (Level of Use, 2/7/00).

Rita continued using Word; however, she began to think about using the Internet for instruction.

My kids do a Louisiana booklet, and they have to research. A lot of times they don't have access to computers. The library has free access, but you can only stay on for an hour. They need seven magazine and seven newspaper articles, and lots of kids don't get any magazines or newspapers about Louisiana. I am still looking for Louisiana authors because I could tell them where to go on the Internet. Then I wanted to try to create a Louisiana trivia game; that way I could give them the sites and have them look for answers to questions. (bulletin board, 3/22/00)

She developed an Internet resource list of language arts websites, providing her with additional resources for her instruction and for her students.

I think it is going to take some time to research and plan what I would like for them to do and how I would like them to do it. My duties are to provide instruction and assistance as they focus on their projects. That being the case, I
need to be well prepared about the Internet myself. Directions and activities will have to be very clear and precise. I want the use of the web to be enlightening, useful, and fun! Just like you had our class construct a "hotlist," I feel like it would be very beneficial to set one up for the students. I know, even for me, it is very easy to get distracted as I begin to search for something. I'm sure that problem would also exist for the students. Setting up guidelines and boundaries should keep the students on track and on task. I really believe the key to success is planning. (bulletin board, 4/4/00)

Her searches also furnished her with articles to critique. Her evaluation of one article's utility caused her to think more about writing.

I liked the article because I really know that I need to be teaching more writing in my classes. Our standards and benchmarks point to that. My objective is to do more, and I believe if I would use the computer, I would get much more done, which, in turn, would mean the students would produce more. I needed something to give me a push into writing because it's one of my least favorite activities. One reason is trying to figure out the handwriting. Word processing would at least make the papers readable! I think the process would work for me even if I couldn't use the computer lab. I could use the TV screen to project work onto and then as a class we could work on revising, etc. (bulletin board, 4/12/00)

Her thoughts about technology integration continued to expand beyond word processing.

In teaching, I use word processing almost everyday. Whatever I need to do for my classes, clubs, or school, I process it and store it on a disc. I have used WordPerfect, MicrosoftWord, WordPad, and NotePad. MicrosoftWord has become my favorite. It has even surpassed WordPerfect, which I had used for the past five years. I do all of my study guides, tests, review sheets, announcements, homework, etc. on the word processor. I store everything on disc rather than the hard drive. I don't really know why, I just do. I have always encouraged my students to use a word processing program to answer any take-home assignments or projects. It just makes it easier for me to read and grade. I don't have to worry about terrible handwriting. In our reading classes, we have an Accelerated Reader computer program which has thousands of tests on books and short stories. After the student reads, he or she comes to the computer, types in his/her name, keys in a password, and then answers 10, 15, or 20 multiple-choice questions. The student must score a 60% to pass. The student immediately knows what the grade is. Besides a passing score on the test, the student earns so many points per book. Readers try very hard to have the top numbers based on their points. Students use the computer almost every day to access the program to take a test, to look at their
reading summaries, or to check to see if a certain book is on the list. One particular unit I teach each year is about poetry. This year I’m going to have my smaller classes use the computer to write a poetry booklet. I’ll be using the computer to instruct the students about the unit with a PowerPoint presentation. The students have to compose different types of poems in class, then find pictures, etc. that go along with them. This will be a perfect opportunity to use Microsoft Word, the Internet, clipart, etc. (bulletin board, 5/2/00)

Rita created a HyperStudio stack on Africa; an activity outlined in the course syllabus.

Development of any hypermedia should fit whatever is being taught. It should be used to more effectively present information. Guidelines to follow would be “does it work?” Planning is the key. Working with graphics, text, etc., should be a learning experience for the teacher and the student. Using it, I feel I should be aware of the capabilities of the program. Whatever hardware or software is used should enhance. I need to pay attention to what I want the end product to be. I need to make the hypermedia work for me. I should also approach this in a specific way, not haphazardly. I need to look at what I’m trying to get across in my use of hypermedia and then look at my options. If it works, use it. If it doesn’t, move on! In working with HyperStudio for the first time, I had some problems. I got so caught up in trying to finish the whole assignment or project that I forgot to save. As I found out, I had to redo several of the cards several times! It’s like once I made one mistake, I ruined the whole card. After doing card three in the first six lessons three times, I figured I better save often. I spent a lot of extra time because of my mistakes. Of course, I got better! I’m going to work with it, because I think it will help me in some instructions I want to do. (bulletin board, 5/11/00).

Rita had talked about integrating technology after ITT. “I would like to teach a unit on poetry. It usually takes two or three weeks. I would start with a PowerPoint presentation and then progress into the students doing their own creative composing” (Level of Use, 3/22/00). She delivered the lesson using PowerPoint and Word during the last week of AMDT.

On May 3, the researcher video-taped and photographed her observation of Rita’s classroom instruction. Rita used a media cart with a TV to present her PowerPoint
presentation. The cart was centered on the left side of her 15 students who sat at desks that were squeezed tightly together in four rows. She appeared nervous as she introduced the lesson, “What is poetry?”

Almost from the start, the interruptions began. A student poked his head into the room and asked, “Can I take my test?”

Apologetically, she replied, “Can you do it tomorrow, honey, please? Thank you.”

She proceeded with her objective as she asked, “Do you ever read poetry?”

This time an announcement on the intercom interrupted her. “Whoever you were supposed to pick up, you don’t have too.”

“Okay,” Rita said. Then she explained to her students, “I think she got the wrong room. I will straighten it out later.” For a third time, Rita attempted to deliver her lesson. The students seemed to be undisturbed by the interruptions, remaining attentive. Drawing from an example of poetry that the students might recognize, she asked, “What about when you read a card? That is a form of poetry.” Several students nodded their heads, acknowledging that they understood. “There are two kinds of writing—prose written in sentences and paragraphs and poetry. How is it written? Lines.”

“James can you read this?” Rita had a student read from the TV monitor. He stumbled on some of the words but with assistance read a poem about a germ by Ogden Nash. Through clues provided by Rita, the students finally realized that a pachyderm was an elephant, but they still did not understand the poem. “What is a germ? What is an elephant? It is funny that they are comparing a large thing with something you can’t see.” The students did not appear to understand the significance. Rita clicked the mouse to
proceed to the next slide and exclaimed, “I don’t know what happened to my little sound.”

There was another interruption.

Someone came to the room to check a student out. The student fretted about leaving for a doctor’s appointment as she left the room. The students, by now, were having a hard time paying attention. It was a solid session of lecture. The presentation did not change the teacher-centered approach. Fifteen slides later, not realizing that the bell was about to ring, she declared, “You are going to be able to write using the computer. You can illustrate your poem with clipart.” Four students were selected to use the computer to compose. Shortly after they were seated, the bell rang. Rita burst out, “Oh my word. I am so sorry!” Although Rita’s presentation design had been flawless, her first delivery of instruction using the computer as a tool was a reminder to all educators of the realities of the classroom.

She had added a third Compaq computer and rearranged the classroom to allow easier access for students. She said, “The students had anticipated using the computer to write their poems.”

The purpose/objective of the lesson was that the learner, after the presentation and discussion, should better understand and appreciate poetry. The learner should be able to identify the elements of poetry, the poetic forms, and the types of poetry. Essentially, Rita was changing her utilization and integration of technology.

When comparing the researcher’s observation data to Rita’s self-reported instructional practice, 50% learner-centered, Borich’s (1996) descriptions of instructional practices (see Observation Log, Appendix K), and descriptors of a constructivist approach
(see Appendix Q), Rita was found to be practicing a student-centered, direct instructional approach supported by technology.

According to the Concerns-Based Adoption Model, Rita’s stages of concerns, as presented in Figure 9, revealed that she had intense self concerns.

![Figure 9. Rita’s stages of concern](image)

ITT and AMDT SoCQs identified an inexperienced user, resistant to the innovation in all months except November 1999. Stage 1, 2, 3, and 6 (Informational, Personal, Management, and Refocusing) self, task, and impact concerns were the most intense during ITT, and Stage 1, 2, and 6 (Informational, Personal, and Refocusing) self and
impact concerns were the most intense during AMDT. According to the model, intense self and task concerns would be normal given the fact that she was still learning how to use technology for personal and professional needs. According to other data collected, Rita had limited use of word processing prior to ITT (Integrating Technology in the Schools-A Presurvey, 9/99). The SoCQ results alerted the researcher as change facilitator to Rita’s specific needs required to resolve her concerns about technology. During coursework, the researcher, as change facilitator and instructor, provided technology information in a variety of ways—individually, in groups, and through an electronic bulletin board. The researcher, accepted Rita’s personal concerns and encouraged a dialog with others in her cohort who felt the same and others who had resolved self concerns about technology. The researcher, in a variety of ways, demonstrated how technology could be implemented one step at a time. The ongoing, sustained coursework enabled Rita to engage in individual and collaborative learning activities to construct her own knowledge about technology integration. She individually planned, developed, designed, and delivered classroom activities demonstrating a traditional instructional approach supported by technology. Her technology article critiques noted reflection on her part. She reflected on technology questions raised by the researcher and posted responses on an electronic bulletin board. These activities provided her with the opportunity to internalize, restructure, and transform new information. With additional time, as Rita successfully resolves self and task concerns, she would be expected to move to impact concerns.

I have learned to have more confidence in using technology in my classroom. I’ve figured out that my using the computer doesn’t always have to go exactly as I’ve planned. It’s just like any teaching tool; lessons don’t always go as the lesson plan indicates. I have also learned that some things don’t work as well as I thought.
they would. What looked good in a lesson plan didn’t work, but that happens in other areas, too. I’m more or less experimenting with just one class this year. Next year, I hope to involve all my classes. We are working on a poetry booklet. I give the students examples; then they begin to compose in Word. They are experimenting with color, size, and font. They are also using clipart to demonstrate their poems. They are very creative! I love the computer and so do my students. I can get them to write poetry without a blink. If I try to get them to compose with pen and paper, it’s extremely difficult. They’re learning and having fun. I feel this course is what really got me motivated to begin more technology use in my classroom. I feel it gave me a better understanding, more so than the one in the fall. I learned, but I didn’t really apply any of it. This course got me involved! It has really excited my students. (bulletin board, 5/7/00)

Throughout the coursework, Rita planned to change her personal and instructional usage of technology. Rita wanted to use a PowerPoint presentation lesson called All About Me. “I would like the kids to do that at the beginning of the year. It is going to be difficult. Some of them will have computers and some of them will not. Some students can work at home or the lab or in the library” (Level of Use, 2/7/00). Rita also discussed technology with other colleagues.

Others have overheard because they have heard me talk about using it more. In fact, one thing that I wanted on my wish list was a TV in the classroom so the kids could actually see it. Of course I put down the little projector, laughing, but nothing will come of it. It would be easier for the kids to see, and I would use it in the class. I can just envision a lot of ways to use it even with one computer. (Level of Use, 2/7/00)

According to the Concerns-Based Adoption Model, Rita’s level of use, as measured by two Level of Use (LoU) interviews, was a Level I (Orientation) for utilization and integration of technology at the beginning of February and May 2000. According to Rita, she had limited use of word processing. Her self-rated minimal computer proficiency also supports LoU data. (Integrating Technology in the Schools-A Presurvey, 9/99). However, after AMDT, data collected in bulletin board responses, LoU
interviews, observations, and computer logs revealed that she was now aware of ways to apply integrated software and other technology tools (HyperStudio) to support instruction. According to the model, Rita was still acquiring information about the innovation and exploring its value and demands upon herself and her students. According to the model and to researchers referred to in the literature review, Rita needed additional time, support, and extended use to accommodate and assimilate the new technology information and skill. Rita had planned on participating in additional technology coursework (Level of Use, 5/11/00).

Irene

With 10 years of seventh and eighth-grade special education teaching experience, Irene initially rated her computer proficiency as a 2 on a scale of 0 (none) to 4 (proficiently) during presurvey (Integrating Technology in the Schools-A Presurvey, 9/99) data collection. In addition to being certified in special education, she was certified to teach business. However, her last computer application courses were taken in 1994. She had a home computer with a word-processing program, which aided in the completion of course assignments and school activities from the start of an Introduction to Technology for Teachers (ITT). She also had Internet access, however, did not routinely use it during that time to correspond with the researcher. Her main concern at the beginning of ITT revealed her lack of access to resources needed to complete coursework. “I am really behind schedule according to the syllabus. I really, REALLY need this program on my computer here at home. Is there any way I can come and pick it up and give it back to you in class?” (e-mail, 9/26/99).
Irene had one full-time paraprofessional to assist her in the classroom. She had one Apple iMAC computer with 400 MHz, 64 Mb of RAM, and 6 Gb hard drive to support her self-reported 60% learner-centered instruction (Integrating Technology in the Schools-A Presurvey, 9/99). She had a printer and an Internet connection. Irene reported, “I do my lesson plans at home” (Level of Use, 3/22/00), which could have explained why the computer was covered with a white trash bag and positioned along a wall beside Irene’s desk, limiting access and use.

Expectation for ITT was: “How to utilize the computer as a teaching/learning tool in my classroom” (Integrating Technology in the Schools-A Presurvey, 9/99). During ITT, Irene learned how to use and apply integrated software, but thought only presentations would be appropriate in her class to support instruction. She described her experience as a good one, stating,

I felt okay with the word-processing part, because I was a little familiar with Works. But I had no idea about spreadsheets, and gosh, the slides. Oh, man, I had a ball with that. I learned how to do a lot of stuff. I had no idea that you could even do that with a computer. I liked the newsletter and graphics. I was afraid of using graphics because I didn’t know how to do them or how to incorporate them, but I love using them now. (Level of Use, 2/7/00)

One interesting aspect of the course was the reversed role for teachers. They had the opportunity to function as both a learner and a teacher. Irene found that technology had a facilitating effect.

As a learner, it is much easier for me to access resources. I don’t have to go to the library or pack around bulky books. I can just go to the Internet and search for whatever I might need. As a teacher, I can see how others do things. I can use things that are already created. It saves me a lot of time and energy. (bulletin board, 3/8/00)
The school system Title I Supervisor awarded a 400 MHz, 64 Mb of RAM and 6.4 Gb hard drive Compaq computer to Irene after completing /TT. She placed the computer in a corner of the classroom where it was accessible to students. The computer had Office 97 pre-installed and was connected to the Internet. However, it did not have a printer.

After /TT, she reported changes in technology utilization. When asked "how," she replied,

In my math class, I am using spreadsheets to teach students how to do graphs. I use the line and bar graphs and let them create some. In my language arts class we are getting ready for the LEAP, so I created a game [in Word] where they have to plug in the correct subject/verb agreement and then they have to do sentences. (Level of Use, 2/7/00)

When asked why she had not done this before the course, she responded, "I didn't know how" (Level of Use, 2/7/00). She later reported, "At the present time, my students are not using technology due to the fact that I only have one computer, and I am not sure how to utilize the one system to benefit the entire class. That is why I took this class" (bulletin board, 3/20/00).

Her personal use of technology during Software Applications, Teaching Methods, and Software Development for Teachers (AMDT) averaged 3 hours per week and was primarily for working on course assignments (Computer Usage Logs, 3-5/00). Irene located articles to critique, identified sites for an Internet resource list, responded to electronic bulletin board questions, and prepared a presentation for instruction. Additionally, Irene created a HyperStudio stack on Africa, as outlined in the AMDT syllabus. However, she provided no feedback on her experience or her intention for future use. Increased use of technology focused on the Internet. She reported,
I think that, as teachers, we should allow students to search the web to answer some of the questions that they discover in the course of classroom discussion. In addition to all of the regular resources (encyclopedias, magazines, textbooks, worksheets, etc.), the web can be an excellent and exciting additional source of endless information. It can be visual reinforcement and interaction, teaching as the students respond to questions presented to them by the different programs. Since some students learn best by doing, the web provides an opportunity for students to actively engage in the learning process. They see how certain things come together as they follow directions and do the steps for themselves. They even get to see what happens if they do not follow the directions. The web provides an excellent opportunity for immediate feedback. It is my belief that the web can take the hum-drum out of the lecture/read/answer-the-questions-at-the-end-of-the-chapter routine. (bulletin board, 4/2/00)

Irene was starting to think about changing her instruction. She was describing a constructivist approach supported by technology integration. Her articles focused on technology integration and impact. Critiques reinforced her perspective about technology as a tool for teaching and learning. She wrote,

As a teaching tool, it [technology] provides hands-on learning, using touch, sight, and thought—which helps the student to retain what is taught. It makes it easy to teach to all learning styles. It can and does enhance learning for the student by providing an unlimited number of resources from which to gather information. (article critique, 4/19/00)

The researcher video-taped and photographed her observation of a lesson Irene designed and delivered on April 26 using a PowerPoint presentation about conjunctions. Her objectives stated, "Upon completion of the presentation and the practice exercise, the students should be able to identify and use conjunctions correctly in sentences." No curriculum standards were referenced on the lesson plan. The presentation was delivered to four of her six students, using the Compaq computer. Her presentation included text, clipart, and sound from within the program. Formal student evaluation was built into the presentation. This was Irene's first use of technology to directly support instruction.
When the researcher entered the spacious classroom, the paraprofessional was seated at her desk monitoring two students who appeared to be taking a test. The researcher was welcomed into the room and introduced to the students. Irene requested the remaining four students in the class to move their chairs in front of the Compaq computer. Smiling, she looked directly at them and asked, "What do you think we are going to talk about?" After waiting a second and receiving no response, Irene said, "A conjunction." She looked at them and asked, "What is it? Anybody know? Tell me one thing you do."

"It connects," one student responded.

"Good," Irene confirmed. "Here are some examples [pointing to the presentation slide on the screen]. A comma comes before a conjunction. A conjunction compares things with neither and nor." Each conjunction came in on the slide with a screeching car sound. Irene looked for a reaction from her students. They appeared to be in awe. Irene enjoyed seeing their expressions. "You are making me laugh. Okay now your turn. What is the conjunction here?" After receiving the correct response, she replied, "Good."

After presenting the lesson, it was time for guided practice. Irene began, "Each of you have a slide with your name on it with two conjunctions. I am going to allow you to make sentences. You are going in to find your slide. How do you do that? Good. Right here." Irene invited the students to volunteer to come to the computer. Exchanging glances, the male student suggested that the girls should go first. Irene said "He is being a gentleman, so ladies first." Irene directed her to the slide sorter view where the student double-clicked the slide identified with her name. Although the students had been
attentive, they appeared more interested now that they were watching another student use
the computer.

“How do I make a capital letter?” the student asked.

“The shift key,” Irene replied. Very slowly and carefully, she selected one key at
time. It also took her a while to think of a sentence. When she did, Irene immediately
commented, “What did she do wrong? Oops.” The students continued to stare at the
computer to watch what she was typing. It took approximately 15 minutes for Irene to
complete her instruction and another 10 minutes for the student to think and type a
sentence on her slide; therefore, the researcher was unable to observe the entire lesson.
However, during the observation the lesson proceeded without any interruptions or
glitches.

When comparing the researcher’s observation data to Irene’s self-reported
instructional practice, 60% learner-centered, Borich’s (1996) descriptions of student-
centered instructional practices (see Observation Log, Appendix K), and descriptors of a
constructivist approach (see Appendix Q), Irene was found to be practicing a student-
centered, constructivist approach supported by technology.

According to the Concerns-Based Adoption Model, Irene’s stages of concerns,
as presented in Figure 10, revealed that she had intense self, task, and impact concerns.
Figure 10. Irene's stages of concern

ITT and AMDT SoCQs identified an inexperienced user, receptive to the innovation in November and May. Stage 0, 1, and 3 (Awareness, Informational, and Management) self and task concerns were most intense during ITT, Stage 1, 4, and 6 (Informational, Consequence, and Refocusing) self and impact concerns were most intense during AMDT. Stage 5 (Collaboration) impact concern was the least intense in pre-ITT, and Stage 0 (Awareness) was the least intense in post-ITT and AMDT SoCQs. According to the model, intense self, task, and impact concerns would be normal given the fact that she was still learning how to use technology for personal and professional needs. According to other data collected, Irene had limited use of word-processing prior
to INT (Integrating Technology in the Schools-A Presurvey, 9/99). The SoCQ results alerted the researcher as change facilitator to Irene's specific needs required to resolve her concerns about technology. During the coursework, the researcher, as instructor, modeled and facilitated a variety of individual and collaborative activities supported by technology. The ongoing, sustained coursework enabled Irene to engage in active learning activities to construct her own knowledge about technology integration. She planned, developed, designed, and delivered a lesson using a constructivist approach supported by technology. She reflected on technology questions raised by the researcher and posted responses on an electronic bulletin board. Irene had internalized, restructured, and transformed new information. At the same time, the researcher as change facilitator applied interventions (see Stages of Concern and Interventions to Facilitate Change, Appendix E) which informed her about technology in a variety of ways, provided practical assistance, fostered collaboration with others in developing technology activities to support instruction, and encouraged the use of technology in small, sequential steps. Irene was still in the early stages of change. She was still in the process of learning how to integrate technology into the classroom. With additional time for her to successfully resolve self and task concerns, she would be expected to move to impact concerns.

Throughout the coursework, Irene sought information about technology and discussed uses for technology with her cohort. She acknowledged, "Even now sometimes when we run into snags, we can go to each other [and ask]. What do we do now? How do I do this? That makes a difference, too" (Level of Use, 2/7/00). She talked to other colleagues in the school; however, she reported, "They do [ask questions about
technology], but it's like 'I don't have time for another class.' It's not really accepted” (Level of Use, 2/7/00). She had been thinking about how to evaluate the use of technology by providing individualized, guided practice where students learn “by doing.” She expressed wanting to change her future use of technology, “Well, I want to expand it, so instead of a projector or overhead or chalkboard,” it is more an “individualized instructional tool. I also want to learn how to connect [chat or take virtual field trips] to other classrooms” (Level of Use, 2/7/00). Her use of technology focused on personal and impact levels.

According to the Concerns-Based Adoption Model, Irene’s level of use, measured by two Level of Use (LoU) interviews, was a Level I (Orientation) for utilization and integration of technology at the beginning of February 2000 and a Level II (Preparation) at the beginning of May 2000. According to Irene, she was already using technology on a limited basis for her own needs. Her self-reported comfortable computer using proficiency (Integrating Technology in the Schools-APresurvey, 9/99) supports LoU data. However, after AMDT, data collected in bulletin board responses, LoU interviews, observations, and computer logs revealed that she was now aware of ways to apply integrated software and other (HyperStudio) technology tools to support instruction. Irene was found to be focusing most of her effort on acquiring information about technology, exploring its value and demands, and preparing for utilization and integration of technology to support classroom instruction. According to the model and to researchers referred to in the literature review, Irene needed additional time, support, and extended use to accommodate and assimilate the new technology information and skill. Irene had no
immediate plans to participate in additional technology coursework. In fact, she left the teaching profession in mid-May to become a truck driver (Level of Use, 5/11/00).

**Monica**

With 3 years of eighth-grade language arts/computer teaching experience, Monica initially rated her computer proficiency as a 3 on a scale of 0 (none) to 4 (proficiently) during presurvey (Integrating Technology in the Schools-A Presurvey, 9/99) data collection. She had a home computer with word processing and presentation programs, which aided in the completion of course assignments and school activities from the start of an *Introduction to Technology for Teachers* (*ITT*); however, she did not have Internet access. When asked how technology has had an impact on her, Monica wrote,

Technology has influenced me tremendously because it has provided me with another alternative for completing projects. I remember the torturous days of the typewriter and liquid paper. With the introduction of the computer, many tasks that I do have become easier. Technology has even provided me with an “at-my-fingertips” method of research. The encyclopedia on CD and the web have made school preparation much easier. The influence technology has had and is having on my life is far more in-depth than I would have conceived 5 years ago. I don’t think I would be able to function as well as I do if my computer and other immediate technological tools were to disappear. Since I am both a teacher and a student, technology has played a role in accomplishing and enhancing these avenues in my life. The importance of technology and my ability to better use it are extremely important to my academic life as a student and even more so in my professional life as a teacher. I am extremely satisfied with and interested in technology and the role it plays in future endeavors. (bulletin board, 3/22/00)

Monica had three Compaq computers with 400 MHz, 64 Mb of RAM, and 6.4 Gb hard drives to support her self-reported 60% teacher-centered instruction. The classroom had one printer and two Internet connections. During *ITT*, no course expectation was recorded (Integrating Technology in the Schools-A Presurvey, 9/99) by Monica;
however, she learned how to use and apply other integrated software (spreadsheets and databases). She wrote,

My experiences with database activities have been extremely limited; however, I would like to try these with my students. The major problem with this is finding the time to select and do a trial run on activities that would be meaningful and easy to implement. (bulletin board, 4/5/00)

As stated earlier, Monica was already using word-processing and presentation programs. However, her perception of activities for word processing—"writing biographies in which you select information from the Internet and cut and paste it directly into your paper or using wacky web tales that help you to use the parts of speech"—was changing. Monica was integrating technology to actively engage her students in the learning process.

After ITT, when interviewed about the weaknesses and strengths of the first course, she stated,

At first, I felt consumed; and at the same time, I wondered why am I doing this because I use Works so much. But as I worked through and got to some of the exercises that were further on in the book, it was okay. I enjoyed it, especially PowerPoint. The shortcuts in the book helped a lot, for me anyway. I would have rather been a little lazy and just had it [the document] in front of me, made the corrections, and been done with it. So, I would have rather done it an easier way. It helped me though, in order to teach my kids how to do it, by having to go through all of that. It keeps you on your toes, and keeps you aware. It definitely makes you think about time management. We need that in class, and it's almost like you have to put things on a deadline and stick to it. (Level of Use, 2/7/00)

After ITT, Monica continued reporting changes in technology utilization and integration, "...learning quick ways to identify websites for information" (computer log, March 13-19, 2000). "I'm becoming addicted to the Internet. There is a multitude of interesting information on the web waiting to be used!" (computer log, April 3-9, 2000)

She reported,
I think teachers can structure meaningful web projects by first investigating the topics and possible websites to use. Second, identify a step-by-step guide for students to follow when accessing sites and finding information for assignments. Third, follow through with it. Finally, analyze and make modifications. (bulletin board, April 5, 2000)

Her personal use of technology during Software Applications, Teaching Methods, and Software Development for Teachers (Amdt) averaged 9 hours per week and was primarily for working on course assignments and school activities (Computer Usage Log, 3-5/00). During Amdt, Monica was also enrolled in two on-campus special education courses further limiting her time. However, she located articles to critique, identified sites for an Internet resource list, responded to electronic bulletin board questions, and prepared a presentation for instruction. Additionally, Monica created a HyperStudio stack on Africa as outlined in the Amdt syllabus. She reported,

I think HyperStudio is a program that provides lessons in planning. The process requires a person to carefully plan and organize information before beginning a presentation. Since editing in HyperStudio is not easy, planning is a prerequisite. In addition, HyperStudio requires much time and energy, whereas PowerPoint is an easier program. Its [HyperStudio] utilization in the classroom is possible. The problem would probably be my ability to teach them how to use it efficiently enough for them to create a project. Of course, I will attempt to implement a couple of lessons into my class next year. (bulletin board, 5/10/00)

Monica’s article critiques reflected her perspective of a constructivist approach and technology integration when she wrote,

I feel the article is informative from the standpoint of an educator. It is very important that we [educators] reshape our thinking and implement more individualized and meaningful learning when appropriate. I think the article is on target with the class [Amdt], especially when dealing with using the one computer in the classroom or focusing on the computer as a tool for instruction. As I evaluate my personal use of the computer, I see where I need more individualized and meaningful instruction about the computer and its applications. At this point, I am in the process of restructuring my use of technology in the classroom. The Internet has much to offer in the area of instruction. The article

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speculated that about 99% of public schools had computers and about 93% used them throughout the year. As the article suggested, having the computers does not necessarily mean they are being utilized for educationally sound purposes. This article along with other information being read has provided me with more reasons and explanations why I [an educator] continue to take computer courses and attend college. Reading articles and handouts about technology in the classroom [AMDT] has provided a different perspective. (bulletin board, 4/5/00)

Monica reported using the Internet all of the time (Level of Use, 3/22/00). Her Internet resource list identified over nine sites, all pertaining to tools for students and teachers to integrate technology. She was logging student grades on a site she had found while searching the web and allowing the student access to his or her own grade. Monica’s view for the utility of the Internet also prompted her to participate in a summer InTech program. Her acceptance entitled her to a new Compaq computer with the same specifications as her other three Compaq computers.

On April 26, the researcher video-taped and photographed her observation of Monica who was delivering an integrated technology lesson on diagraming sentences to 30 students. One Compaq computer was positioned against a blackboard close to the classroom door on the south wall and faced the students. Beside it on the left, the monitor facing the west wall, was another Compaq computer on the teacher’s desk. Two other Compaq computers were flush against the west wall in the far left-hand corner of the classroom. The two computer monitors were in a cross position so that neither was facing the class nor were students seated at the computers able to see the work of others. The students were crowded in desks that faced the east wall. On the west wall, facing the backs of the students, was a TV monitor connected to the computer for whole-class instruction. Everyone was quiet as she began her lesson, standing in front of the students.
One student was asked to explain what she had been learning this week. After receiving no response, Monica said, "Okay, this TV is not in here. [The researcher] is not in here. Now talk to me."

Almost inaudibly, the student replied, "Diagraming sentences."

"We talked about diagraming compound sentences. Go to the board and diagram one for me. Somebody else? Let's see." Monica picked another student. Several students were laughing at what appeared to be the two students' apprehension of being selected by the teacher. Using a white board, they began to diagram sentences.

Monica directed another student to the teacher's desk to begin the PowerPoint presentation. "Don't tear up my computer while you are back there." The student appeared to be having trouble finding or opening the presentation; therefore, Monica walked to the desk to see if she could assist her. After the student opened the presentation, Monica walked to the middle of the classroom. The two students were still working on diagraming sentences. The others watched intently.

One student finished and returned to his desk. When the other student finished diagraming her sentence, Monica asked her to explain what she had done. The student answered; however, she appeared to be unsure of her response which prompted Monica to ask, "Are you asking or telling?"

"Telling," the student said.

"Good," Monica replied. "Give her a hand."

Now the attention of Monica and the class turned to the student seated at the teacher's computer. Monica addressed the students, "She always wants to run the class,
so she is going to run the PowerPoint. I know it [TV] is hard to read.” The student began to read the objectives of the lesson from the teacher's computer screen before proceeding to definitions of terms and examples of diagraming sentences.

Monica would reinforce parts of speech and ask questions frequently. “This shows the indirect object. What is that line called? Are you reading?” Students sat quietly and listened as Monica again tried to get a response. “What is that first line called?” Waiting. “What is the first line called? Good. What is the second line called? It is right there on the screen. Come on people. If I ask you that again every day until the end of school, you will know. Okay, keep reading. What is the subject of the sentence? What is the verb? Good.”

Again, the student read aloud to the class while Monica asked questions. “What is the word ‘not’?” There was no response. The class was quiet; however, they all appeared to be listening and watching the TV. “Okay, stop right there. We have not started on gerunds.” The student reading the presentation was asked to return to her seat, and Monica reviewed the lesson objectives with the class, talking about the parts of speech they covered in today’s lesson and how that knowledge would help them learn other parts of speech.

Four students were directed to the computers for 15 minutes to work on presentations and diagraming sentences. The others remained at their seats working on diagraming sentences. Monica monitored the students at the computers and desks. She also met her objectives: (a) identify subject, verb, predicate adjective, predicate noun, direct objects, and indirect objects; and (b) draw basic diagraming patterns. Monica was changing her utilization and integration of technology. She wrote,
I have been using the computer as an instructional tool for my classes. It does require careful planning for both the teacher and the students. For me, allowing my students to use the computers individually has increased my student's desire to learn, especially if the projects are to be done on the computer. Several of my students have been reluctant about using the computer as a tool to assist them. The first time I used the technology for instruction it took several hours during several days to plan, then several more days to convince myself to try it. The use of the media cart [TV with connector to computer] has gained their interest, especially since I allow them to operate the computer sometimes. They are provided both structured and unstructured activities that require them to develop computer maturity and responsibility. (bulletin board, 5/10/00)

When comparing the researcher's observation data to Monica's self-reported instructional practice, 60% teacher-centered, Borich's (1996) descriptions of student-centered instructional practices (see Observation Log, Appendix K), and descriptors of a constructivist approach (see Appendix Q), Monica was found to be practicing a teacher-centered, direct instructional approach supported by technology. After the lesson, some of Monica's students were engaging in an instructional activity which was supported by technology. According to the Concerns-Based Adoption Model, Monica's stages of concerns, as presented in Figure 11, revealed that she had intense self and impact concerns.

ITT and AMDT SoCQs identified an inexperienced user, receptive to the innovation in September and March. Stage 2, 3, and 6 (Personal, Management, and Refocusing) self, task, and impact concerns were most intense during ITT, and Stage 2, 5, and 6 (Personal, Collaboration, and Refocusing) self and impact concerns were most intense during AMDT. Stage 6 (Refocusing) impact concern was the least intense in pre-ITT, and Stage 1 and 2 (Informational and Personal) were the least intense in post-ITT. Stage 0 and 3 (Awareness and Management) self and task concerns were the least intense
in post-ITT and AMDT SoCQs. According to the model, intense self, task, and impact concerns would be normal given the fact that she was still learning how to use technology for personal and professional needs. According to other data collected, Monica was already using technology prior to ITT (Integrating Technology in the Schools-A Presurvey, 9/99). The SoCQ results alerted the researcher as change facilitator to Monica's specific needs required to resolve her concerns about technology. During the coursework, the researcher, as instructor, modeled and facilitated a variety of individual and collaborative activities supported by technology. The ongoing, sustained coursework enabled Monica to engage in active learning activities to construct her own knowledge.
about technology integration. She planned, developed, designed, and delivered a lesson using a traditional approach supported by technology. She reflected on technology questions raised by the researcher and posted responses on an electronic bulletin board. Monica had internalized, restructured, and transformed new information. At the same time, the researcher as change facilitator applied interventions (see Stages of Concern and Interventions to Facilitate Change, Appendix E) which informed her about technology in a variety of ways, provided practical assistance, fostered collaboration with others in developing technology activities to support instruction, and encouraged the use of technology in small, sequential steps. Monica was still in the early stages of change. She was still in the process of learning how to integrate technology into the classroom. With additional time for her to successfully resolve self and task concerns, she would be expected to move to impact concerns.

Throughout the coursework, Monica sought information about technology and discussed uses for technology with her cohort. She acknowledged, “We are always trying to help each other with different things” (Level of Use, 2/7/00). She talked to other colleagues in the school; however, she reported, “Most of the new teachers are working on certification and that is why they aren’t interested [in taking the courses]” (level of use, 2/7/00). She had been thinking about how to evaluate the use of technology by providing individualized, guided practice in which students would learn “by experimenting.” She expressed a desire to change her future use of technology; “I want the students to use the computer. We can write, edit, and share each other’s work” (Level of Use, 2/7/00). Her use of technology focused on an impact level.
This course has personally and professionally helped me to learn other strategies for using the computer. It has helped me to identify the benefits that can be reaped from the computer. True enough, there are disadvantages but the advantages supersede the others. The impact has engulfed so many different ideas for implementation for future teaching. I have decided to use a PowerPoint presentation during the first days of school. I have enjoyed working with you [the researcher] in this class. I hope to conduct several workshops next school year with my cohort—one for teachers integrating technology and one for personal use, such as a grade book and lesson plans. (bulletin board, 5/10/00).

According to the Concerns-Based Adoption Model, Monica's level of use, as measured by two Level of Use (LoU) interviews, was a Level III (Mechanical) for utilization and integration of technology at the beginning of February and a Level IVB (Refinement) at the beginning of May 2000. According to Monica, she had prior use of word processing and presentations. Her self-rated confident computer proficiency also supports LoU data. (Integrating Technology in the Schools-A Presurvey, 9/99). However, after AMDT, data collected in bulletin board responses, LoU interviews, observations, and computer logs revealed that she was now aware of ways to apply integrated software and other technology tools (HyperStudio) to support instruction. According to the model, Monica had advanced from a state in which she focused on the short-term, day-to-day utilization and integration of technology to the increased impact of technology on students and colleagues. Monica changed her personal use of the innovation to incorporate a variety of student uses (using the Internet to find information, creating quizzes on the Internet, and PowerPoint grammar drill skills). Consequently, these changes caused her to renew her use of technology. According to the model and to researchers referred to in the literature review, Monica needed additional time, support, and extended use to accommodate and assimilate the new technology information and skill. Monica had
immediate plans to participate in a doctoral program in curriculum and instruction with a concentration in educational technology (Level of Use, 5/11/00).

**Amanda**

With 6 of her 8 years teaching experience in seventh and eighth-grade special education, Amanda initially rated her computer proficiency as a 1 on a scale of 0 (none) to 4 (proficiently) during presurvey (Integrating Technology in the Schools-A Presurvey, 9/99) data collection. She had a home computer with Internet access and word-processing and presentation programs, which aided in the completion of course assignments and school activities from the start of an *Introduction to Technology for Teachers (ITT)*. When asked how technology had an impact on her, Amanda wrote,

> Although technology has influenced me a great deal, I can't use it in my classroom because I only have two computers. However, I would love for my students to be able to do lessons on the computer. I would put science chapters on the computer and have my students answer questions. Since technology is the future and students need to know how to use it, I need to become competent enough to teach my students how to use lessons on the computer. I want to get to the point where I use computer-generated lessons and grade book. (bulletin board, 3/15/00)

Amanda's classroom initially had one Apple iMAC computer with 400 MHz, 64 Mb of RAM, 6 Gb hard drive, a printer, and Internet connection to support her 60% teacher-centered instruction. Her expectation for *ITT* was to “make maximum use of my computer as far as my classroom is concerned” (Integrating Technology in the Schools-A Presurvey, 9/99). A Compaq computer with 400 MHz, 64 Mb of RAM, and 6.4 Gb hard drive was presented for classroom use by the school system Title I Supervisor at the end of *ITT*. After learning how to use and apply integrated software, Amanda wrote,
I feel different about letting some of my students use the computer now. I am aware that the entire class does not have to be sitting at a computer for me to teach them a lesson. I used the Internet for my lesson on weather. After spring break, I am going to have each student come to the computer to answer a question they have been given. I now have other ideas on how to implement technology (computers) into my classroom. (bulletin board, 3/27/00)

After ITT, when interviewed about the weaknesses and strengths of the course, Amanda reported,

[It was] a lot of work! I enjoyed it though and I did learn a lot, especially the slide presentations. The only thing I felt was a weakness of the course was that we stayed on Word too long. The strength of the course was getting involved in the lesson. I think it always helps to get the students involved and excited about what they are doing. (Level of Use, 2/7/00)

Although Amanda felt differently about integrating technology, she still expressed

the same concerns of only having two computers.

Lessons for my earth science and life science classes will be difficult because two of my classes are mixed with both subjects. In earth science we are studying the solar system, so I am going to have each student access the Internet and answer questions about a planet. In life science we are discussing the systems of the body, specifically the digestive system. Students will be assigned an organ that is part of the digestive system and will answer questions. This will be time consuming unless I do a group activity. The students will enjoy it, but it is difficult because of the limitation of only having two computers. (bulletin board, 4/5/00)

Her personal use of technology during Software Applications, Teaching Methods, and Software Development for Teachers (AMDT) averaged 5 hours per week and was primarily for working on course assignments and school activities (Computer Usage Log, 3-5/00). Amanda was enrolled in ITT to refresh her technology skills, having obtained computer literacy certification 7 years ago. Articles she located on the Internet and critiqued in Word, revealed that she supported technology integration. “I feel, as an educator, we need continuous inservice about computer programs and computer
applications in the classroom. Computers are here, but there are educators who do not know what to do with them." (article critique, 5/3/00). She created an Internet resource list of Internet sites which were later used to develop a PowerPoint presentation for her science class.

Amanda designed a HyperStudio stack on Africa as outlined in the AMDT syllabus. She reported,

I really don't think I will use HyperStudio in my classroom. I didn’t care for the fact that you cannot correct mistakes easily. I even had to start all over several times, which was very time consuming. It probably took me 4 to 6 hours total to work through the lesson. Students may be able to use HyperStudio to develop a mini project, although it will be difficult to teach. (bulletin board, 5/6/00)

On April 26, the researcher video-taped and photographed her observation of Amanda delivering an integrated technology lesson on the solar system to six students. One Compaq computer was moved a few feet from behind Amanda’s desk to face a semi-circle of students. As Amanda prepared to begin the lesson, Channel 1 came on, diverting the students’ attention. Effortlessly, Amanda picked up a yardstick, turned off the TV, and recounted what they had talked about in previous lessons on space.

Her objectives were presented on the second slide of her PowerPoint presentation and stated that students would learn planets in their order from the sun, learn important facts about the solar system, learn how the revolution and rotation of other planets compare to Earth’s, and learn about other objects in addition to planets in the solar system. “Now we are going to talk about the solar system. You will learn the nine planets in their order from the sun. That is why you did your model and why I have this poster up.”
Initially, students appeared interested with the presentation, which incorporated animation and sound. Advancing to the third slide, Amanda continued, “You are going to learn about the sun. The sun is the largest star.”

Each slide presented five to six facts and contained a colorful graphic of the planet. Students were prompted to answer and ask questions. “How many days in our year? Why is our planet blue? What is a continent?” The researcher noted that Amanda knew her subject and had designed an excellent presentation. However, just minutes into the lesson, her students appeared to have little interest. Only one student answered her questions, several were yawning, and two were staring at their desks.

Nearing the end of the lesson, a train rumbled in the background, and Amanda had to wait a few minutes before asking, “How far away is Pluto from the sun?” Again, the same student answered.

“Now this is how to remember your planets in order from the sun. ‘Mr. Vampire eats many juicy strawberries under nine pancakes.’ Each word represents the first letter of a planet.” The students slowly stirred and repeated the sentence.

“Now we are going to work on your assignment. Any questions? You may look at the presentation again if you need to.” Students were then handed a worksheet with 14 questions on the solar system. Although none of her students individually used the computer, Amanda was changing her utilization and integration of technology. She wrote,

I enjoyed using the computer as an instructional tool. I think the lesson went well. I even did the same lesson with my next earth science class. The response was good. The students did an excellent job on the worksheet that was given afterward. I will try to utilize the computer in the future. This was my first time using the computer for instruction. It took me several hours, probably more than 5 because of the glitches. However, it was worth it. (bulletin board, 5/6/00)
When comparing the researcher's observation data to Amanda's self-reported instructional practice, 60% teacher-centered, Borich's (1996) descriptions of student-centered instructional practices (see Observation Log, Appendix K), and descriptors of a constructivist approach (see Appendix Q), Amanda was found to be practicing a teacher-centered, direct instructional approach supported by technology.

According to the Concerns-Based Adoption Model, Amanda's stages of concern, as presented in Figure 12, revealed that she had intense self and task concerns.

![Figure 12. Amanda's stages of concern](image)
ITT and AMDT SoCQs identified an inexperienced user, receptive to the innovation in November and March. Stage 0 and 3 (Awareness and Management) self and task concerns were most intense during ITT, Stage 1 and 3 (Informational and Management) self and task concerns were most intense during AMDT. Stage 0 (Awareness) self concern was the least intense in pre-ITT, and Stage 4 and 5 (Consequence and Collaboration) were the least intense in post-ITT and AMDT SoCQs. According to the model, intense self and task concerns would be normal given the fact that she was still learning how to use technology for personal and professional needs. According to other data collected, Amanda had used technology prior to ITT (Integrating Technology in the Schools—A Presurvey, 9/99). The SoCQ results alerted the researcher as change facilitator to Amanda’s specific needs required to resolve her concerns about technology. During the coursework, the researcher, as instructor, modeled and facilitated a variety of individual and collaborative activities supported by technology. The ongoing, sustained coursework enabled Amanda to engage in active learning activities to construct her own knowledge about technology integration. She planned, developed, designed, and delivered a lesson using a traditional approach supported by technology. She reflected on technology questions raised by the researcher and posted responses on an electronic bulletin board. Amanda had internalized, restructured, and transformed new information and skills. At the same time, the researcher as change facilitator applied interventions (see Stages of Concern and Interventions to Facilitate Change, Appendix E) which informed her about technology in a variety of ways, provided practical assistance, fostered collaboration with others in developing technology activities to support instruction, and
encouraged the use of technology in small, sequential steps. Amanda was still in the early stages of change. She was still in the process of learning how to integrate technology into the classroom. With additional time for her to successfully resolve self and task concerns, she would be expected to move to impact concerns.

As stated earlier, Amanda was relearning technology applications to support instruction. She remained concerned about management of technology, specifically “how to use” the one or two computers in her classroom. Throughout the coursework, Amanda sought information about technology and discussed uses for technology with her cohort. “It really helped to have the other teachers in the class. We could help one another and see how to apply technology in different content areas” (Level of Use, 2/7/00). Although Amanda discussed technology with her cohort, she reported little communication about technology with other colleagues in the school. In spite of the fact that Amanda wanted her students to use technology, she never designed a lesson actively engaging her students. Her use of technology focused on personal and management levels.

Personally, I am drained because I am pursuing two other graduate classes. Professionally, I have learned that just because a teacher has limited technology skills, it does not mean that a teacher cannot utilize technology in the classroom. Technology is the future, and without students having access to technology, their future is limited. (bulletin board, 5/6/00)

According to the Concerns-Based Adoption Model, Amanda’s level of use, measured by two Level of Use (LoU) interviews, was a Level II (Preparation) for utilization and integration of technology at the beginning of February 2000 and a Level III (Mechanical) at the beginning of May 2000. According to Amanda, she had used technology 7 years ago. Her self-reported minimal computer using proficiency
(Integrating Technology in the Schools-A Presurvey, 9/99) supports LoU data. However, after AMDT, data collected in bulletin board responses, LoU interviews, observations, and computer logs revealed that she was now aware of ways to apply integrated software and other technology tools (HyperStudio) to support instruction. Amanda was found to be focusing on the short-term, day-to-day use of technology. Changes in use were made more to meet her needs than her student needs. She was primarily engaged in a stepwise attempt to master the tasks required to use technology. According to the model and to researchers referred to in the literature review, Amanda needed additional time, support, and extended use to accommodate and assimilate the new technology information and skill. Amanda had no plans for immediately participating in additional technology coursework (Level of Use, 5/11/00). Triangulation of other data collected in electronic bulletin board responses, observations logs including video-tape and photographs, computer logs and other course documentation (course assignments and presentations) supported Amanda’s SoCQ technology concerns and LoU technology usage.

Myrna

With 5 years of seventh and eighth-grade special education teaching experience, Myrna initially rated her computer proficiency as a 2 on a scale of 0 (none) to 4 (proficiently) during presurvey (Integrating Technology in the Schools-A Presurvey, 9/99) data collection. She had a home computer with Internet access and word processing and presentation programs, which aided in the completion of course assignments and school activities from the start of an Introduction to Technology for Teachers (ITT). When asked how technology has had an impact on her, Myrna wrote,
Technology has really influenced me. Technology has cut down on my phone bill; I have corresponded with friends that I thought I would never hear from again. Technology has made it easier for me to complete many assignments; I have been able to find a lot of lesson plans on the Internet. However, I do not use technology a lot in my classroom because I teach Special Education and do not feel comfortable using it yet. Overall, I think technology is the greatest thing since the invention of the television. (bulletin board, March 8, 2000)

Myrna had one Compaq computer with 400 MHz processor, 64 Mb of RAM, and 6.4 Gb hard drive to support her 60% teacher-centered instruction. She also had one Apple iMAC computer with 400 MHz processor, 64 Mb of RAM, and 6 Gb hard drive in an unopened box. There was one printer and one Internet connection. Myrna had one full-time paraprofessional in her classroom. During ITT, no course expectation was recorded; however, she learned how to use and apply integrated software. She was presented with a second Compaq computer, with the same specifications as stated above, for classroom use by the school system Title I Supervisor at the end of ITT. Although Myrna had three computers and new knowledge of how to apply technology, she wrote,

At this point I can't show you anything about using the computer in the classroom. I want to do a fun activity from the book that you left us; however, my special education students sometimes get out of control when I am not looking directly at them. Therefore, I plan to use this knowledge in a future job. (bulletin board, 3/15/00)

After ITT, when asked to describe her experiences during the course, Myrna stated,

At the beginning of the quarter, I was a little intimidated because I wasn't familiar with the computer terms or the computer programs. However, when I was able to install the program (Office 97) at home, I had time to practice and become more comfortable with it. I began to use the program at school and at church. This class made me aware of how to use technology in the classroom and provided me with the opportunity to directly experience these uses. (Level of Use, 2/7/00)

Her personal use of technology during Software Applications, Teaching Methods, and Software Development for Teachers (AMDT), averaged 10 hours per week and was
primarily for working on course assignments and school activities (Computer Usage Log, 3-5/00). Myrna used the Internet to locate articles, identify sites for an Internet resource list, respond to electronic bulletin board questions, and prepare a presentation for instruction. Additionally, Myrna created a HyperStudio stack on Africa as outlined in the AMDT syllabus. She reported,

HyperStudio is a program that requires a lot of time. Although planning is essential and time consuming, unanticipated problems add to the extensive time allotment. I started over so many times due to technical problems that I would rather use PowerPoint than HyperStudio at this point. (bulletin board, 5/15/00)

Myrna's article critiques revealed her perspective on technology integration. "A lot of administrators are not aware of what teachers need in order to integrate technology. A great deal of money is spent on equipment and not much on teacher training" (article critique, 4/5/00). "Teachers need to continuously read articles and take technology classes in order to integrate technology and ultimately improve teaching and learning" (article critique, 5/3/00).

On April 26, the researcher video-taped and photographed her observation of Myrna delivering an integrated technology lesson on poetry to six students. Myrna was seated beside her computer which was on a table along the west wall of her classroom. Students were seated in two rows facing the computer. A PowerPoint slideshow was presented to aid students in understanding poetry. Myrna explained, "You will be able to use context clues to find the meaning of words and to understand the poem." Pointing to the screen, she began to read the poem. "The beach is a pleasant place to visit. Its beauty is natural and exquisite. When you hear the word natural, what does it mean?"

"Normal," one student responded.
"Good, what else?" After no one answered, Myrna asked, "What does exquisite mean?"

"Exciting."

"Good, what else? Courtney, that outfit you have on looks exquisite."

"Beautiful!"

"Good. What feeling do you get when you go to a beach? How do you feel? Is it peaceful?"

Again, the same student who responded throughout said, "Not to me."

Dialog continued between the student and Myrna. "What does gritty mean? Have you have pulled your shoes off on a beach? How did it feel?" The same student responded.

"That is the end of the poem. Now let's look at some questions to see how much you remember. First, who is she walking with?" A slide with four choices appeared.

"C—a dog," another student finally answered.

Myrna replied, "Good. A dog." as another slide appeared with a barking dog.

The researcher noted that Myrna never got up from her seat or looked at her students periodically. Her focus was on the computer screen. The researcher noted that the students liked the sound effects presented on the answer slides. Although they did not all participate in answering questions while Myrna read the poem, the students appeared attentive when reviewing questions.

When all the questions had been answered, Myrna acknowledged, "Now, what I could have you do is divide into groups. You could access the Internet and look for poems and later come back to share with the class; however, I have to do this on a
different date.” Myrna then turned her attention to the researcher. The students, appearing unaffected by what Myrna had just stated, turned to one another and started talking.

When comparing the researcher’s observation data to Myrna’s self-reported instructional practice, 60% teacher-centered, Borich’s (1996) descriptions of instructional practices (see Observation Log, Appendix K), and descriptors of a constructivist approach (see Appendix Q), Myrna was found to be practicing a teacher-centered, direct instructional approach supported by technology.

According to the Concerns-Based Adoption Model, Myrna’s stages of concerns, as presented in Figure 13, revealed that she had intense self and task concerns.

![Figure 13. Myrna’s stages of concern](image-url)
ITT and AMDT SoCQs identified an inexperienced user, who was receptive to the innovation in November and March. Stage 1 and 2 (Informational and Personal) self concerns were most intense during ITT, and Stage 1, 2, and 3 (Informational, Personal, and Management) self and task concerns were most intense during AMDT. Stage 0 and 4 (Awareness and Consequence) self and impact concerns were least intense during ITT, and Stage 0 and 5 were least intense during AMDT. According to the model, intense self and task concerns would be normal given the fact that she was still learning how to use technology for personal and professional needs. According to other data collected, Myrna had limited use of technology prior to ITT (Integrating Technology in the Schools-A Presurvey, 9/99). The SoCQ results alerted the researcher as change facilitator to Myrna’s specific needs required to resolve her concerns about technology. During the coursework, the researcher, as instructor, modeled and facilitated a variety of individual and collaborative activities supported by technology. The ongoing, sustained coursework enabled Myrna to engage in active learning activities to construct her own knowledge about technology integration. She planned, developed, designed, and delivered a lesson using a traditional approach supported by technology. She reflected on technology questions raised by the researcher and posted responses on an electronic bulletin board. Myrna had internalized, restructured, and transformed new information and skills. At the same time, the researcher as change facilitator applied interventions (see Stages of Concern and Interventions to Facilitate Change, Appendix E) which informed her about technology in a variety of ways, provided practical assistance, fostered collaboration with others in developing technology activities to support instruction, and encouraged the use
of technology in small, sequential steps. Amanda was still in the early stages of change. She was still in the process of learning how to integrate technology into the classroom. With additional time for her to successfully resolve self and task concerns, she would be expected to move to impact concerns.

Throughout the coursework, Myrna remained apprehensive about using technology in her classroom. She acknowledged, "Experienced teachers are not really familiar with the computers, and we are afraid to try new things because the computer intimidates us" (Level of Use, 2/7/00). She did not talk about technology to other colleagues outside of her cohort. She wanted to learn about integrating technology; however, she wanted to apply it in another setting.

According to the Concerns-Based Adoption Model, Myrna's level of use, as measured by two Level of Use (LoU) interviews, was a Level I (Orientation) for utilization and integration of technology at the beginning of February 2000 and a Level II (Preparation) at the beginning of May 2000. According to Myrna, she was already using technology on a limited basis for her own needs. Her self-reported comfortable computer using proficiency (Integrating Technology in the Schools-APresurvey, 9/99) supports LoU data. However, after AMDT, data collected in bulletin board responses, LoU interviews, observations, and computer logs revealed that she was now aware of ways to apply integrated software and other (HyperStudio) technology tools to support instruction. Myrna was found to be focusing most of her effort on acquiring information about technology, exploring its value and demands, and preparing for utilization and integration of technology to support classroom instruction. According to the model and to researchers...
referred to in the literature review, Myrna needed additional time, support, and extended use to accommodate and assimilate the new technology information and skill. Myrna had no immediate plans to participate in additional technology coursework. However, she was planning on implementing technology in another position at another school. (Level of Use, 5/11/00).

**Themes and Categories**

Qualitative researchers “seek answers to questions that stress how social experience is created and given meaning” (Denzin & Lincoln, 1994, p. 4). In this case study, a cohort of teachers was utilizing and integrating technology through extension coursework taught by the researcher using a constructivist approach. The first 10-week, 3.75 hour/week course, *Introduction to Technology for Teachers (ITT)*, was delivered during the fall quarter of 1999. The second 10-week, 3.75 hour/week course, *Software Applications, Teaching Methods, and Software Development for Teachers (AMDT)*, was delivered during the spring quarter of 2000. The intent of the coursework was to allow teachers to construct technology knowledge and to apply integrated thematic units customized to their classroom needs. Data collected at the beginning of *ITT* assisted in determining initial attitudes, skills, and technology usage and guided the researcher in developing objectives and activities appropriate to the needs of individual teachers.

During *AMDT*, answers to interview questions and postings to bulletin board reflections revealed how teachers were using technology to support instruction and how they felt coursework assisted in this endeavor. Stages of Concern questionnaires, Levels
of Use categories, classroom observations, and course documents served as additional sources of data to triangulate in order to substantiate the changes in teachers’ concerns and levels of technology use.

Stake (1995) emphasized that full coverage of all data was impossible and equal attention to all data was not a civil right. Further, Stake validated that “the case and the key issues need to be kept in focus” (p. 84). Thus, as stated in Chapter 1, the study looked for patterns or themes that supported the integration of technology. Although Stake held the case as a special something to be studied—not a problem, a relationship, or a theme—he contended that as data were triangulated, issues would emerge.

Through extensive reading, reflecting, and triangulating of data, the researcher discovered emerging patterns and categories. Lincoln and Guba (1985) suggested unitizing the emerging data as the basis for defining categories. First, the unit should reveal information relevant to the study and should stimulate the reader to think beyond the particular piece of information. Second, the unit should be interpretable in the absence of any additional information. Consequently, this study produced two categories from teachers’ interviews, bulletin board responses, observations of their technology coursework development, and observations of their utilization and integration of technology in the classroom.

**How to Use Technology Effectively**

The first category to emerge from teacher descriptions was the issue of how to use technology. During JTT teachers were asked to identify course expectations and self-rate
their computer proficiency (see Integrating Technology in the Schools-A Presurvey, Appendix I). Although, expectations and self-rating varied, teachers' statements revealed that seven teachers had no prior knowledge of how to use technology in the classroom and three, although they had prior knowledge of how to use technology, did not know how to integrate technology to support classroom instruction.

After expressing the desire to learn how to use word processing, databases, spreadsheets, presentation, multimedia, and computer-assisted instruction (Integrating Technology in the Schools-A Presurvey, 9/99), Sandra Jo, who did not know how to use the computer in the classroom, exceeded her expectations. She produced a lesson plan with word processing software, entered information in one computer in her classroom for her students to experience a database activity, and queried information to create a graph in Excel.

Kim expected to learn "How to integrate technology better" (Integrating Technology in the Schools-A Presurvey, 9/99) because she did not know how to use or manage the one computer in her classroom.

It has been hard to find time for the students to access the computer. We need to look at the one computer classroom. Making time in the day with everything else we have going on is difficult. I can come up with great subjects, but it takes time and management. Figuring out what to do with the other 20 when those 3 are at the computer and planning for rotations between centers, takes time and management. (Level of Use, February 4, 2000)

Monica also declared that the major problem with integrating technology was finding the time. However, she felt that it was imperative to try.

It is very important that we [educators] reshape our thinking and implement more individualized and meaningful learning when appropriate. I think the article is on target with the class [AMDT], especially when dealing with using the one
computer in the classroom or focusing on the computer as a tool for instruction.

As I evaluate my personal use of the computer, I see that I need more individualized and meaningful instruction about the computer and its applications. As the article suggested, having the computers does not necessarily mean they are being utilized for educationally sound purposes. This article, along with other information being read, has provided me with more reasons and explanations why I [an educator] continue to take computer courses and attend college. Reading articles and handouts about technology in the classroom during AMDT has provided a different perspective. (article critique, April 5, 2000)

Regardless of teachers' prior use, identifying meaningful applications for students appeared to make the difference in changing teachers' uses of technology. Five elementary school teachers were using technology (educational software) prior to ITT to reinforce basic skills. These teachers learned how to use application programs to integrate teacher-created, thematic, content-standard based lessons. However, two junior high school teachers were using technology (Accelerated Reader and application programs [Works and PowerPoint]) prior to ITT to reinforce language arts skills. Four junior high school teachers, who did not know how to use technology prior to ITT, either had computers that were never removed from their original boxes or were covered up in a remote corner of the classroom. After AMDT, 11 teachers used application programs to integrate teacher-created, thematic, content-standard based lessons. Identifying teachers' attitudes, skills, behaviors, and technology use to develop objectives and activities appropriate to the needs of individual teachers appeared to have a facilitating effect.

The Effect of Coursework

The second category to emerge from teacher descriptions was the effect of coursework on teachers' utilization and integration of technology. All teachers stated that the course had a favorable effect. The teachers appreciated engaging in activities based
on individual needs, having the support of a cohort, receiving guidance from the researcher, and sharing ideas and experiences.

Sandra came to realize that through "trial and error you can learn how to do a whole lot" (Level of Use, March 2000). She recommended, "Just stick with it! Just take your time and don't give up after the first session or two. It'll be okay and it'll be worth it!" (e-mail, January 5, 2000). Although Kathy felt the first course was too basic for her, she acknowledged that other people needed the basics—how do you do it. Consequently, because she had to go through the basics, she did learn some tips and shortcuts (Level of Use, February 4, 2000). Sandra Jo conceded that at the beginning of the course she knew enough to use the computer as a typewriter. However, she did not know how to save to a floppy or know what "save" and "save as" meant. Even though she had been told to use computer technology in the classroom, she did not know what to do (bulletin board, March 29, 2000).

I reluctantly signed up for the computer courses because I knew nothing. I knew I had to learn because the new teaching standards were demanding students become computer literate, and I had to be comfortable with computers before I could help others. Plus, I wanted to learn just for myself. I am elated over the knowledge I have acquired. Not only am I using my newly acquired skills in the classroom, but also the skills are helping me with many other activities in which I am involved. Thank you for your [researcher] encouragement and constantly telling us we can do the work. Your [researcher] flexibility helped relieve a lot of stress. (bulletin board, May 6, 2000)

Sandra Jo believed that "the advantage of taking a class is that I have to do it and that I am guided in what I can do" (bulletin board, February 4, 2000). Claudia learned valuable information by taking the technology class. She felt "more at ease using a computer. Before ITT, I had almost no experience with any of these tools (Word, Excel,
Access, and PowerPoint) other than a quick exposure in a course several years ago” (bulletin board, April 4, 2000). Rita described her experience in the course as a positive one.

Well, working at my own speed, your explaining and demonstrating something to us, and then getting to do it. If I had a problem you were right there or somebody in the room could help. It made a difference. (Level of Use, February 7, 2000)

I feel this course [AMDT] is what really got me motivated to begin using more technology in my classroom. I feel like it gave me a better understanding, more so than the one in the fall. I learned, but I didn’t really apply any of it. This course got me involved! It has really excited my students. (bulletin board, May 7, 2000)

Irene learned how to use spreadsheets, presentations, and graphics. “I had no idea that you could even do that with a computer” (Level of Use, February 7, 2000). The support of a cohort made a difference too. “When we run into snags, we can go to each other [and ask]. What do I do now? How do I do this?” (Level of Use, February 7, 2000).

At first, Monica felt consumed, and at the same time, wondered why she was taking a course in application programs.

But as I worked through and got to some of the exercises that were further on in the book, it was okay. I enjoyed it, especially PowerPoint. The shortcuts in the book helped a lot, for me anyway. I would have rather been a little lazy and just had it [the document] in front of me, made the corrections, and been done with it. But it helped me though, in order to teach my kids how to do it, by having to go through all of that. It keeps you on your toes, and keeps you aware. It definitely makes you think about time management. We need that in class, and it’s almost like you have to put things on a deadline and stick to it. (Level of Use, February 7, 2000)

Amanda said that technology influenced her a great deal (bulletin board, March 15, 2000). “I now have other ideas on how to implement technology (computers) into my classroom” (bulletin board, March 27, 2000). Although she felt the course was a lot of
work, she enjoyed it and did learn a lot, especially how to use slide presentations. “The strength of the course was getting involved in the lesson. I think it always helps to get the students involved and excited about what they are doing” (Level of Use, February 7, 2000). “It really helped to have the other teachers in the class. We could help one another and discover how to apply technology in different content areas” (Level of Use, February 7, 2000). Myrna felt a little intimidated because she was unfamiliar with the computer terms and the computer programs. However, when she was able to install the program (Office 97) at home, she had time to practice and become comfortable with it. “This class made me aware of how to use technology in the classroom and provided me with the opportunity to directly experience these uses” (Level of Use, February 7, 2000).

Summary

The purpose of this study was to investigate the learning process of teachers as they begin to implement an innovation. Teachers’ changes in attitudes, skills, behaviors, and perceptions of coursework were analyzed through triangulation of presurvey, questionnaire, interview, observations including video-tape and photographs, electronic correspondence, course documentation including computer logs, and descriptors of a constructivist approach to learn how they effectively integrate technology during the first year of implementation. Teachers’ preliminary data (responses to surveys and questionnaires) assisted in the development of course objectives and activities. Consequently, this approach promoted teacher involvement and teacher interaction. Teachers’ perceptions of the courses, as evidenced by their cases, were very positive.
Teachers’ cases although varying from teacher to teacher, provided a picture of the activities incorporated in the extension technology coursework instructed by the researcher and of the effect it had on teachers’ use of technology in their classrooms. The researcher’s observations, photographs, and video taken during classroom observations confirmed teachers’ stages of concern about technology, levels of technology use, perceptions about coursework impact on technology use and integration, and practices and perceptions about teaching and learning with technology.

The teachers individually assisted one another in solving technical and instructional dilemmas. The teachers also worked together within their cohort planning activities and units to be used with their students. These collaborative opportunities allowed the teachers to experience problem solving in a group instead of working as isolated individuals. As a result of their experiences, the teachers were better prepared to handle the disequilibrium created when experiencing new or contradicting prior knowledge.

The categories that emerged from the teachers’ cases indicated that the constructivist approach used in the extension technology courses was indeed different from other professional development experienced in the past. The teachers appreciated being given the opportunity to contribute to the planning and implementation of course activities, which were ultimately used to support their classroom instruction. Sharing activity and project ideas with other teachers in the cohort was noted as an important experience of both courses. Being actively involved in the course development, rather than sitting passively listening to an instructor, was described as a positive aspect of both
courses. Based on their answers to interview questions and reflections to bulletin board postings, the teachers enjoyed and learned from their experiences while participating in a constructivist approach to technology utilization and integration.
CHAPTER 5

FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

Discussion of Findings

Based on a review of literature, technology is increasingly seen as a learning tool that places great demands on teachers to use technology to support instruction. Teachers’ acceptance, training, and utilization of technology are the only assurances that technology will support instructional practices (Carlin et al., 1997; Charp, 1997; Kent & McNergney, 1999). Teacher’s beliefs about instruction and learning, knowledge about new technologies, and prior attitudes toward technology determine whether and how students will get to use computers (Cuban, 1995b). O’Donnell (1996) found that teachers did not understand how to use computers in the teaching process. Meltzer and Sherman (1997), like O’Donnell, believed that technology implementation must target the needs of teachers. They insisted that training be ongoing and periodically assessed for participants’ progress and emerging needs. Marsh (1999) found that teachers must learn through experimenting, reading, attending computer education meetings, and interacting with other teachers involved with computers.

Professional development is a process, like change, which impacts teachers’ classroom practices (Hall & Hord, 1987). In a 4 year study by the Apple Classrooms of
Tomorrow (ACOT), teachers experienced intense inner conflicts as they explored alternative approaches that sharply contrasted their beliefs (Dwyer, Ringstaff, Haymore, & Sandholtz, 1990). Initially, teachers struggled as they spent most of their time learning how to use technology. This phase was followed by a period in which teachers adopted technology to support familiar methods and materials. Teachers discovered that they could cover standard curriculum in less time with technology, leaving more time for higher-order learning and problem solving. However, as teachers implemented a constructivist approach to learning in their classrooms, they had to change their beliefs. This phase proved more challenging to work through. The study found that although a constructivist approach facilitated change, change was personal and did not occur quickly.

In another study by Becker (1994) on computer using teachers, findings revealed that teachers were changing their teaching styles to incorporate constructivist approaches supported by technology; however, teachers had to want to teach this way and believe that is was legitimate. Teachers initially used technology to strengthen a curriculum taught in a lecture-recitation-seatwork mode. They gradually changed their teaching to include more dynamic learning experiences for students.

The purpose of this study was to investigate the learning process of teachers as they begin to implement an innovation. Teachers' changes in attitudes, skills, behaviors, and perceptions of a constructivist coursework were analyzed through triangulation of multiple data sources to learn if teachers were able to resolve concerns, change their use of technology, and effectively integrate technology during the first year of implementation. With national emphasis on technology use in the classroom and financial
support provided by government and education institutions, there is a need to investigate how technology impacts teaching and learning.

Two, 10-week, 3.75 hour/week, university extension courses, *Introduction to Technology for Teachers (ITT)* and *Software Applications, Teaching Methods, and Software Development for Teachers (AMDT)*, were designed with a constructivist approach to the integration of technology into elementary and junior high school classrooms through the use of thematic units. Two sections of each course were taught simultaneously at two different schools during the 1999-2000 academic school year. One section of the course was taught to an elementary school cohort and the other section was taught to a junior high school cohort. A constructivist perspective to learning characterized the setting for the coursework component of the study. The Concerns-Based Adoption Model (Hall et al., 1973) provided the framework for investigating changes that occurred during implementation of an innovation. The researcher functioned as the instructor, change facilitator, and participant observer during this study.

The researcher's roles were fundamental to the study. The relationship between instructor and teacher enabled the researcher to enter each teacher's world. Although the researcher's roles were an integral part of the study, the relationship may have had an impact on teacher concern and level of technology use. The researcher would like to acknowledge that case study teachers' grades were not affected by their participation in the study, although teachers may have felt compelled to do better than those not participating in the study. Triangulation of multiple data sources served as a "chain of evidence" (Yin, 1994) to strengthen overall data findings and to address internal validity.
ITT course objectives were aligned with guidelines developed by the International Society for Technology in Education. Teachers learned basic computer/technology operations and concepts to include word-processing, presentation, spreadsheet, and database integrated software applications. They applied technology for their own professional growth and productivity and supported their own classroom instruction with the use of technology. The teachers learned and applied these applications in an environment designed with a constructivist approach to learning.

In this approach, as teachers encountered information that was new or contrary to prior knowledge, they were faced with the notion of disequilibrium (Piaget, 1954). Each teacher had to resolve his or her own discord or concern by incorporating that information as part of his or her view of the world. Adjustments to the way he or she viewed the information and its relationship to what he or she already knew were made in the form of accommodations. When successful, the information became internalized or assimilated.

Integrating Technology in the Schools - A Presurvey was administered in September 1999 to collect demographic and baseline technology-related information (Appendix I). Stages of Concern Questionnaires (Hall et al., 1979) were administered in September 1999 and November 1999 to identify concerns and provide the researcher with data needed to apply concerns-based interventions to facilitate teachers in resolving their technology concerns.

After the first course, the researcher selected participants to include in the study. A brief individually scheduled and recorded Level of Use Interview was conducted in February 2000 to discuss stages of concerns and to learn if teachers were using technology
Teachers were selected if they taught at one of the two extension course school sites, had a computer in their classroom, and were planning to enroll in the second extension course which was designed to extend teachers' knowledge and skills from an introductory level to an instructional application level. These criteria resulted in the identification of 12 teachers to participate in a follow-up case study.

The second course, *Software Applications, Teaching Methods, and Software Development for Teachers (AMDT)* began in March 2000. Course activities included cooperatively designing a multimedia project using HyperStudio, using the Internet as an instructional resource, evaluating educational software, delivering classroom instruction with the support of technology, reading and responding to technology reflection questions electronically, critiquing technology articles, and creating a portfolio of course projects. For a second time, teachers experienced the notion of disequilibrium (Piaget, 1954).

The Stages of Concern Questionnaires administered in September 1999, November 1999, March 2000, and May 2000 were used to analyze changes in stages of concerns about technology. The researcher, with the help of an undergraduate student, hand-scored stages and plotted scores on a computer spreadsheet to graph data. Pre-*ITT* SoCQ data found teachers had high Stage 1 (Informational) and Stage 2 (Personal) self-concerns, high Stage 3 (Management) task concerns, and high Stage 5 (Collaboration) impact concerns. Post-*ITT* SoCQ data found teachers had high Stage 0 (Awareness), Stage 1, Stage 2, Stage 3, and Stage 6 (Refocusing) concerns. Pre-*AMDT* SoCQ data found teachers had high Stage 0, Stage 1, Stage 2, Stage 3, and Stage 6 concerns. Post-*AMDT* SoCQ data found teachers had high Stage 0 through 6 concerns. Sandra Jo had 99% on four different
concerns - Stages 1, 2, 3, and 6. According to the model, as teachers resolved self and task concerns, they would increase the intensity of impact concerns and decrease the intensity of self and task concerns. As a group, data found that teachers were resolving self and task concerns and were found to be in the early stages of change.

The Levels of Use Interviews were individually scheduled and tape-recorded in February/March 2000 and May 2000 to learn how teachers were using technology. Interviews were transcribed by the researcher, with the help of an undergraduate student, and verified by teachers. No corrections were necessary. February/March LoU data found that one teacher was a Level 0 (Nonuse), five were a Level I (Orientation), three were a Level II (Preparation), two were a Level III (Mechanical), and one was a Level IVA (Routine) user. May 2000 LoU data found three teachers were Level I, two were Level II, four were Level 3, and three were Level IVB users. Data from the LoU was linked with SoCQ data to strengthen the findings. As a group, data found that teachers were changing their levels of technology use.

Qualitative methods used in this study provided for a more concrete, contextual, and constructed knowledge of each teacher's case (Stake, 1995). Their changes in stages of concerns and levels of use, experiences in coursework, and practices in the classroom provided a vivid picture and better understanding that, in turn, could affect and perhaps even improve educational practices (Merriam, 1998). Through extensive reading, reflecting, and triangulating of data from the Stages of Concern questionnaires (SoCQ), Level of Use (LoU) interviews, electronic bulletin board responses, and classroom observations, the researcher identified categories.
The first category, the effect of a constructivist approach to coursework, was found to have a facilitating effect on teachers' resolving concerns and changing their levels of technology use. The second category to emerge was the issue of how to use technology effectively. Regardless of teachers' prior technology use, identifying meaningful applications for students was found to facilitate teacher use of technology to support instruction.

Triangulation of data strengthened the findings in the study and provided data to answer the following questions.

1. How do teachers' stages of concerns about technology change after completing "ITT and AMDT"?

Teachers concerns changed from self to task and impact concerns as indicated in Table 3.

All teachers had high self concerns. These data alerted the researcher as instructor and change facilitator to apply interventions suggested by the concerns-based model. Interventions included sharing information about technology without overwhelming, providing a safe environment for asking questions, and demonstrating sequential steps to incorporate technology. Information was provided in a variety of ways - individually, in groups, and through the use of electronic mail and electronic bulletin board. Teachers were encouraged to talk to one another and read each other's bulletin board responses. Demonstrations were built around teachers' need and skill. Engaging, hands-on activities were supported by cohort collaboration. Teachers critiqued articles, evaluated educational
<table>
<thead>
<tr>
<th>Teacher SoCQ User</th>
<th>9/99 – SoCQ Concern(s)</th>
<th>11/99 – SoCQ Concern(s)</th>
<th>3/00 – SoCQ Concern(s)</th>
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Table 3 (continued)

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software, accessed the Internet to find resources, responded to electronic bulletin board questions, and designed and delivered lessons supported by technology. Concerns-based interventions did facilitate individual teacher change.

Data from post-AMDT found seven teachers to be resistant to the innovation. These data are important for a number of reasons. Teachers had not accepted the innovation. Teachers were resolving multiple concerns. First, they had different attitudes and skills associated with technology. For some, the incorporation of technology into classroom practices meant they would have to change the way they teach. This study supported findings from Dwyer et al. (1990) and Becker (1994). Change was personal and did not occur overnight.

Given the time limitation of the study and length of time needed to implement change (3 to 5 years as reported in the literature) it would not be unusual for Stages 0, 1, and 2 to remain intense, while Stages 3, 4, 5, and 6 increase in intensity. It would not be unusual for all teachers to have intense Stages 2-5, considering all teachers were learning how to effectively utilize and integrate technology. Triangulation of other data sources, bulletin board responses, observations including video-tape and photographs, and course documents strengthened these findings.

2. How do teachers' levels of technology use change after completing ITT and AMDT?

Teachers' levels of technology use changed from acquiring new skills and information to utilizing and integrating technology effectively. During AMDT, results revealed that nine teachers changed their behavior and patterns of technology innovation use (Table 4).
<table>
<thead>
<tr>
<th>Teacher</th>
<th>9/99 Presurvey Computer-Using Proficiency</th>
<th>9/99 Presurvey Coursework Expectation</th>
<th>SoCQ</th>
<th>2/00 Levels of Use</th>
<th>5/00 Levels of Use</th>
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<td>3 – Confidently</td>
<td>How to integrate technology better.</td>
<td>Inexperienced</td>
<td>III – Mechanical</td>
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<td>2 – Comfortably</td>
<td>To gain computer skills to help my students and myself.</td>
<td>Experienced</td>
<td>II – Preparation</td>
<td>IVB – Refinement</td>
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<td>1 – Minimally</td>
<td>How to use computer for work and home.</td>
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<td>Kathy</td>
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<td>Experienced</td>
<td>IVA – Routine</td>
<td>IVB – Refinement</td>
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<td>Sandra Jo</td>
<td>1 – Minimally</td>
<td>How to use all Office applications, Internet, etc. to support instruction.</td>
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<td>I – Orientation</td>
<td>III – Mechanical</td>
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<td>Claudia</td>
<td>1 – Minimally</td>
<td>To learn all the new technology that has come out for computers in teaching, since it has been several years since I took a course.</td>
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<td>II – Preparation</td>
<td>III – Mechanical</td>
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<td>To learn how to use the computer to help me and to be able to teach a computer class.</td>
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<td>IVB – Refinement</td>
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<td>Amanda</td>
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</tbody>
</table>
Kim remained at Level III (Mechanical), and Sandra and Rita remained at Level I (Orientation). Christy changed from Level II (Preparation) to Level IVB (Refinement); Kathy changed from Level IVA (Routine) to Level IVB (Refinement); Sandra Jo changed from Level I (Orientation) to Level III (Mechanical); Claudia changed from Level II (Preparation) to Level III (Mechanical Use); Deric changed from Level 0 (Nonuse) to Level I (Orientation); Irene changed from Level I (Orientation) to Level II (Preparation); Monica changed from Level III (Preparation) to Level IVB (Refinement); Amanda changed from Level II (Preparation) to Level III (Mechanical); and Myma changed from Level I (Orientation) to Level II (Preparation).

This study supports findings from Dwyer et al. (1990) and Becker (1994). After teachers learned how to use technology, they used it to meet personal needs and then to support classroom instruction. A constructivist approach to implementing technology was easier for teachers already practicing with a learner-centered approach. Levels of use data provided benchmarks indicating the rate at which change was progressing and intervention was needed. Again, interventions facilitated change. Triangulation of other data sources, bulletin board responses, observations including video-tape and photographs, and course documents strengthened these findings.

3. How do teachers integrate technology after completing ITT and AMDT?

Data collected and described in teachers’ case studies revealed that they were effectively integrating technology to positively impact teaching and learning. However, teachers were integrating technology into the classroom in a variety of ways (see Table 5).
<table>
<thead>
<tr>
<th>Teacher</th>
<th>SoCQ</th>
<th>LoU</th>
<th>Personal Use</th>
<th>Classroom Use</th>
<th>Excerpts from Teacher Profiles that Matched Constructivist Descriptors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kim</td>
<td>Inexperienced</td>
<td>III</td>
<td>From word processing to produce lesson plans, letters, and fliers to working on course assignments such as applying integrated software, accessing the Internet to find teaching resources to responding to questions on an electronic bulletin board to developing, designing, and delivering a PowerPoint lesson to support her classroom instruction.</td>
<td>From educational software to reinforce basic skills to using the Internet to reinforce basic skills to developing, designing, and delivering a PowerPoint presentation in her classroom on Insects.</td>
<td>“guide students” bb4/4/00 “exposure” bb3/21/00 “make their own” bb3/20/00 “build” LoU5/1/00</td>
</tr>
<tr>
<td>Christy</td>
<td>Experienced</td>
<td>II</td>
<td>From lesson plans, school forms and memos to working on course assignments with integrated software, accessing the Internet to find teaching resources to responding to questions on an electronic bulletin board to developing and designing an instructional activity created with HyperStudio, PowerPoint, and Storybook Weaver.</td>
<td>From creating “Little Books” to read to drilling skills to accessing the Internet to reinforce basic skills to evaluating educational software to creating interactive Farm Animals (SWD and HS) and Louisiana (PP) computer learning-centers.</td>
<td>“guidance”bb4/4/00 “explore” bb3/21/00 related to prior knowledge</td>
</tr>
</tbody>
</table>

Table 5

How Teachers Use Technology
<table>
<thead>
<tr>
<th>Teacher</th>
<th>SoCQ</th>
<th>Lou</th>
<th>Personal Use</th>
<th>Classroom Use</th>
<th>Excerpts from Teacher Profiles that Matched Constructivist Descriptors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sandra</td>
<td>Inexperienced</td>
<td>Orientation</td>
<td>From IEPs to learning to use integrated software to using the Internet and e-mail to working on course assignments with integrated software, accessing the Internet to find teaching resources to responding to questions on electronic bulletin board to designing a Power-Point and Word instructional activity.</td>
<td>Delivered ABC, 123 (PP) and Mother’s Day card (Word) instructional activities.</td>
<td>“hands-on”ac4/18/00</td>
</tr>
<tr>
<td>Kathy</td>
<td>Experienced</td>
<td>IVA</td>
<td>From lesson plans to school activity sheets to working on course assignments with integrated software, accessing the Internet to find teaching resources to responding to questions on an electronic bulletin board to developing and designing an instructional activity created with HyperStudio, PowerPoint and Storybook Weaver.</td>
<td>From work sheets to drilling skills to accessing the Internet to find information to using a teacher-created thematic interactive lesson at the computer learning center.</td>
<td>“a building block of knowledge” bb4/4/00 “they figure things out” o4/1/100</td>
</tr>
<tr>
<td>Teacher</td>
<td>SoCQ</td>
<td>LoU</td>
<td>Personal Use</td>
<td>Classroom Use</td>
<td>Excerpts from Teacher Profiles that Matched Constructivist Descriptors</td>
</tr>
<tr>
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<td>------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Sandra Jo</td>
<td>Inexperienced</td>
<td>I</td>
<td>From using a computer program to print cards to working on course assignments with integrated software, accessing the Internet to find teaching resources to responding to questions on an electronic bulletin board developing and designing an instructional activity created with Access and Excel.</td>
<td>From drilling skills to accessing the Internet to reinforcing basic skills to integrated software supporting instructional Measurement (Access and Excel) lesson.</td>
<td>&quot;teacher must spend time&quot; &quot;students seek answers&quot;bb3/29/00 &quot;encourage&quot; &quot;flexibility&quot;5/6/00 &quot;I have to do it ...I am guided&quot; LoU2/4/00</td>
</tr>
<tr>
<td>Claudia</td>
<td>Inexperienced</td>
<td>II</td>
<td>From IEPs to working on course assignments with integrated software, accessing the Internet to find teaching resources to responding to questions on an electronic bulletin board developing and designing an instructional activity created with PowerPoint and HyperStudio.</td>
<td>From drilling skills to creating an Insect PowerPoint presentation and Dinosaur HyperStudio stack to student creating slides within the presentation.</td>
<td>&quot;building knowledge&quot; &quot;problem solving&quot;bb3/27/00</td>
</tr>
<tr>
<td>Deric</td>
<td>Inexperienced</td>
<td>0</td>
<td>From working on course assignments with integrated software to accessing the Internet for sports and e-mail to searching for WWII information to designing an instructional lesson.</td>
<td>N/A</td>
<td>&quot;I learned&quot; bb4/12/00</td>
</tr>
<tr>
<td>Teacher</td>
<td>SoCQ</td>
<td>LoU</td>
<td>Personal Use</td>
<td>Classroom Use</td>
<td>Excerpts from Teacher Profiles that Matched Constructivist Descriptors</td>
</tr>
<tr>
<td>---------</td>
<td>------------</td>
<td>-----------</td>
<td>-------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Rita</td>
<td>Inexperienced</td>
<td>I Orientation</td>
<td>From lesson plans and letters to working on assignments with integrated software to accessing the Internet for teaching resources to responding to questions on an electronic bulletin board to designing a poetry presentation using PowerPoint.</td>
<td>From Accelerated Reader to Poetry presentation to students creating poetry presentations.</td>
<td>&quot;working at my own speed, your explaining and demonstrating, getting to do it&quot; &quot;somebody to help&quot; LoU 2/7/00 knowledge</td>
</tr>
<tr>
<td>Irene</td>
<td>Inexperienced</td>
<td>I Orientation to II Preparation</td>
<td>From lesson plans and letters to working on assignments with integrated software to accessing the Internet for teaching resources to responding to questions on an electronic bulletin board to designing a grammar presentation using PowerPoint.</td>
<td>N/A Using spreadsheets to create graphs to delivering a Conjunction PowerPoint presentation to students creating slides within the presentation.</td>
<td>&quot;students learn best by doing&quot; &quot;discover&quot; &quot;actively engage&quot; bb 4/2/00 &quot;hands-on&quot; ac 4/19/00</td>
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</table>
### Table 5 (continued)

<table>
<thead>
<tr>
<th>Teacher</th>
<th>SoCQ</th>
<th>LoU</th>
<th>Personal Use</th>
<th>Classroom Use</th>
<th>Excerpts from Teacher Profiles that Matched Constructivist Descriptors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monica</td>
<td>Inexperienced to Renewing</td>
<td>III</td>
<td>From lesson plans and letters to working on assignments with integrated software to accessing the Internet for teaching resources to responding to questions on an electronic bulletin board to designing a grammar presentation using PowerPoint.</td>
<td>From Accelerated Reader to Diagramming Sentences PowerPoint presentation to students creating documents using Word and PowerPoint.</td>
<td>“at my fingertips method of research” bb 3/22/00 “Individualized and meaningful learning” bb 4/5/00 “guided practice” LoU 2/7/00</td>
</tr>
<tr>
<td>Amanda</td>
<td>Inexperienced</td>
<td>II</td>
<td>From IEPs to working on assignments with integrated software to accessing the Internet for teaching resources to responding to questions on an electronic bulletin board to designing a science presentation using PowerPoint.</td>
<td>N/A</td>
<td>“getting involved” LoU2/7/00</td>
</tr>
<tr>
<td>Myrna</td>
<td>Inexperienced</td>
<td>I</td>
<td>From lesson plans and letters to working on assignments with integrated software to accessing the Internet for teaching resources to responding to questions on an electronic bulletin board to designing a poetry presentation using PowerPoint.</td>
<td>N/A</td>
<td>“directly experience” LoU2/7/00</td>
</tr>
</tbody>
</table>
SoCQ and LoU data revealed that teachers must learn how to use technology for themselves and then learn how to apply technology that is meaningful and supports their classroom instruction. Teachers must be placed in a state of discord in order to accommodate and assimilate new information. Initially, in ITT, teachers integrated technology indirectly. Technology usage focused on teachers' needs. Teachers were learning how to use word processing, presentation, spreadsheet, and database software applications to indirectly support classroom instruction.

In AMDT, teachers integrated technology directly. First, they planned for technology integration to include the students' needs. Teachers were learning how to design and deliver instructional lessons enhanced by software applications and Internet resources. Teachers were implementing and evaluating instruction supported by technology.

Kim and Claudia developed and designed a PowerPoint presentation on insects and a HyperStudio stack on dinosaurs. Christy and Kathy developed and designed a PowerPoint presentation on Louisiana, a Storybook Weaver electronic book on farm animals, and a HyperStudio stack on farm animals. Sandra developed and designed a PowerPoint presentation on A-B-Cs and created a Mother's Day card using Word. Sandra Jo developed and designed a lesson on measurement using Access and Excel. Deric developed and designed a World War II presentation using PowerPoint. Rita developed and designed a poetry lesson using PowerPoint. Irene developed and designed a lesson on conjunctions using PowerPoint. Monica presented a PowerPoint grammar lesson found on the Internet. Amanda developed and designed a solar system lesson using PowerPoint.
Myrna developed and designed a poetry lesson using PowerPoint. Additionally, teachers used the Internet to locate graphics, data, and instructional activities.

**Conclusions**

Stages of Concern and Levels of Use data may describe attitudes and behaviors associated with technology but do not explain causality or describe how teachers' feel about technology usage. Therefore, additional data were needed to understand the how and why of teacher technology use. Recorded interviews provided descriptions of teachers' perceptions on the initial use of technology during the first year of implementation. Recorded observations documented actual practices of technology use in the classroom during the first year of implementation. Both provided a better understanding of the processes involved for teachers in the integration of technology. Data described in teacher profiles were analyzed for categories. Two themes emerged, how to use technology effectively and the effect of coursework. Conclusions are offered below:

1. Introduction of site-based, teacher recruited coursework designed with a constructivist approach can change teacher attitudes, skills, and levels of technology usage.

2. Interventions suggested in the Concerns-Based Adoption Model can change teacher attitudes, skills, and levels of technology use.

3. A period of discord or discomfort is a normal part of the learning process.

4. Effective use of technology can be achieved when a teacher identifies meaningful applications for his or her student.
Recommendations

As the ideals of constructivism and professional development become more closely linked, results of these studies could provide a rationale for the addition of ongoing professional development using a constructivist approach. Based on the findings in this study, teachers are in need of technology training designed with a constructivist approach.

With the start of a 3rd-year cohort on the horizon, the researcher anticipates the continued challenge of facilitating teachers in their use of technology in the elementary school and junior high school. If all parties involved—teachers, administrators, students, parents, and instructors—can be persuaded to become actively involved in the planning and implementation of the goals, maybe, over time they too can appreciate the possibilities of a constructivist approach to professional development.

On the basis of the findings of this study and the discussion in the previous section, the following recommendations are offered.

1. Technology integration should include extension coursework using a constructivist approach to facilitate engaging, hands-on, activity-based, problem-centered curricula that are flexible and based on the needs of each teacher.

2. Technology instruction should ascertain the needs of each teacher and provide meaningful applications and appropriate support and assistance.

3. Technology instruction should include a cohort of colleagues in order to share a common vision and network of support.
4. Adequate facilities, equipment, and resources should be available for teachers to incorporate theory into classroom practice.

5. Access to equipment and resources, both during and after school, should be available for teachers to alleviate frustration and expedite the integration of technology.

6. Administrators should support teachers who seek professional development in technology integration and provide resources to facilitate and sustain the use of technology.

Based on the findings of this study, the following recommendations for future research are offered.

1. Teachers involved in this study should be interviewed and observed periodically to determine the attitudes, skills, behaviors, and uses of technology over an extended period of time. Data would assist in sustaining technology usage and in determining need for professional development, equipment, and resources.

2. Students whose teachers participated in the study should be assessed to determine student attitude toward and use of technology in the classroom.

3. Teachers not participating in the coursework but teaching within targeted schools should be surveyed to determine the perceived influence of the teachers' participating in the study on the integration of technology.

4. Additional qualitative studies that describe in depth teacher attitudes, skills, behaviors, and uses of technology innovation should be undertaken.
When reforms are being prescribed and innovations are being suggested, teachers are expected to implement innovations in their classrooms. Teachers involved in this study have been exposed to new ways of integrating technology through the use of a constructivist approach. It is the researcher’s belief, as supported by the literature, that these new ways of teaching and thinking about teaching will be incorporated gradually in the coming years. When these teachers begin to assess their own changes in their teaching practices and the needs of their students, the impact of the coursework will be realized. However, future research will be needed to determine whether the long-term use of the approach will produce the desired outcomes.
APPENDIX A

INTRODUCTION TO TECHNOLOGY
FOR TEACHERS SYLLABUS
EDUCATION 445: Introduction to Technology for Teachers  
Instructor: Dawn Basinger  
Winter 2000 Quarter  
WH 111 Office Hours: 8-12 M-F  
Office: 257-2794 Home: 255-8286 E-mail: dbasing@woodard.latex.edu

Course Overview: This course is designed to demonstrate basic computer/technology operations and concepts; utilize an integrated software program (Office 97) and email (Netscape Navigator) for personal and professional productivity; and apply computer/technology operations and concepts in instruction. (International Society for Technology in Education Foundation Standards/Guidelines)


Materials: Binder, 5 disks (minimum)

Course Requirements: (Access to a computer with Microsoft Office 97 Professional Version is not required outside of class but will facilitate the requirements of this course.)

Student participation in class activities and assignments are critical for your successful completion of the course. Therefore, attendance is required unless other arrangements have been made with the instructor.

All assignments must be saved on a floppy disk with your name on a label. Disks must be turned in at the end of the quarter. Hard copies of all assignments must have name, date, and exercise # in a header on the document. Copies of all assignments must be in a binder for weekly review.

A reflective email journal must be maintained during the course duration. Reflect on access, use, and application of each lesson. Email weekly.

Evaluation Procedures:

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<thead>
<tr>
<th>Software</th>
<th>Weight</th>
<th>Assignment</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Word 97</td>
<td>150</td>
<td>Lesson Plan</td>
<td>50</td>
</tr>
<tr>
<td>Excel 97</td>
<td>100</td>
<td>Candy is Dandy</td>
<td>50</td>
</tr>
<tr>
<td>Access 97</td>
<td>100</td>
<td>Traits R’ Us</td>
<td>50</td>
</tr>
<tr>
<td>PowerPoint 97</td>
<td>150</td>
<td>All About Me</td>
<td>50</td>
</tr>
<tr>
<td>E-Mail/Journal</td>
<td>150</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A 940 1000  
B 860 939  
C 780 859  
D 700 779

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### Word 97

<table>
<thead>
<tr>
<th>Due</th>
<th>Lesson</th>
<th>Exercises</th>
<th>Other</th>
<th>Journal</th>
<th>Binder</th>
<th>Disk</th>
<th>Date Completed</th>
<th>Hours</th>
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<tr>
<td>Dec 14</td>
<td>Create and Print Documents</td>
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<td>Open and Edit Documents</td>
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<td>Dec 21</td>
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<td>Format and Edit Documents</td>
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<td>Jan 4</td>
<td>Clip Art and Templates</td>
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<td>Envelopes and Labels</td>
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### Excel 97

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<th>Disk</th>
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<td>Use Formulas; Format; Copy; Print</td>
<td>5-8, 10</td>
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<td>Additional Formatting and Editing</td>
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<tr>
<td>Jan 18</td>
<td>Charting</td>
<td>35-38</td>
<td></td>
<td></td>
<td>Candy is</td>
<td>Dandy!</td>
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Candy is Dandy!
### Access 97

<table>
<thead>
<tr>
<th>Due</th>
<th>Lesson</th>
<th>Exercises</th>
<th>Other</th>
<th>Journal</th>
<th>Binder</th>
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<td>Edit and Print a Database</td>
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<td>Reports</td>
<td>23-28</td>
<td>Traits R' Us</td>
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### PowerPoint 97

<table>
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<tr>
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<th>Lesson</th>
<th>Exercises</th>
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<th>Journal</th>
<th>Binder</th>
<th>Disk</th>
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<th>Hours</th>
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<tbody>
<tr>
<td>Feb 8</td>
<td>Create, Save, and Print a Presentation</td>
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<td>Enhance Slides</td>
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<tr>
<td></td>
<td>Work with Text and Objects</td>
<td>7-12</td>
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<tr>
<td>Feb 15</td>
<td>Work with Slide Shows</td>
<td>14-17</td>
<td>All About Me</td>
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</table>
APPENDIX B

SOFTWARE APPLICATIONS, TEACHING METHODS, AND SOFTWARE DEVELOPMENT FOR TEACHERS SYLLABUS
EDUCATION 489C-87: Special Topics—Software Applications, Teaching Methods, and Software Development for Teachers
Spring 2000 March 7 – May 9, 2000 Tu 4:00 – 7:45
Instructor: Dawn Basinger Office: Woodard Hall 111 (M-F 8-10)
Home Phone: 255-8286 Office Phone: 257-2794
Home E-mail: basinger@bayou.com
Office E-mail: dbasing@woodard.latex.edu


Course Objectives:
A. Students will operate a multimedia computer system with related peripheral devices to successfully install, run and use a variety of software, evaluate software components, and apply basic troubleshooting strategies as needed. (ISTE 1.1)

B. Students will apply tools for enhancing their own professional growth and productivity through communication and collaboration of activities and projects that encourage learning and use of computer/technology resources. (ISTE 1.2)

C. Students will apply advanced computer technologies to support instruction in their grade level and subject areas by planning and delivering thematic instruction supported by technology. (ISTE 1.3)

D. Students will use productivity tools and telecommunications and information access which supports instruction. (ISTE 2.2, 2.3)

E. Students will develop simple hypermedia and multimedia products that apply basic instructional design principles. (ISTE 2.4.2)

Course Requirements:
Student attendance, participation in all class activities and completion of assignments for the class sessions are critical to the successful completion of the course. In accordance with University policies, attendance will be checked to provide a permanent record. NOTE: All assignments must be computer generated and saved to a disk. Assignments will be evaluated for content and clarity of thought as well as proper grammar, spelling, and punctuation.
### Course Grade:

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<td><strong>Bulletin Board</strong></td>
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<td><strong>Class Activities</strong></td>
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<td><strong>Lesson Plans</strong></td>
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<td><strong>Projects</strong></td>
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<td><strong>Articles</strong></td>
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<td>800</td>
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</table>

G 1000-900=A, 899-800=B, 799-700=C, 699-0=F
U 800-700=A, 699-600=B, 599-500=C, 499-0=F
| Due    | Read                                                                 | Reflect on the following FOCUS QUESTIONS | Using "Bulletin Board" Respond to FOCUS QUESTIONS 225 pts | Save to YOUR Disk 60 pts | Class Activities 225 pts | Lesson Plans 90 pts | Articles 100 pts | Projects 300 pts | Total Points 1000 pts |
|--------|                                                                     | Consider how technology has influenced you as (1) a learner or student and (2) a teacher. | Type response in Word. Access Bulletin Board and respond. (25) | Save "Response" in Word. (5) | □ Form groups □ Bulletin Board □ Lesson Plans □ Articles □ Projects (25) | In groups review ISTE NETS curriculum and lesson plans. | Review article critique guidelines. | Review projects and criteria. | 55 |
| Mar 7  | 1. Key Themes and Issues for Using Technology in your Classroom    |                                                                                         |                                                                      |                                                                          |                                                                           |                                                                     |                                                                        |                                                            |    |
| Mar 21 | 6. Learning with Internet Tools                                    | With so many resources available on the WWW, how can teachers structure web projects to engage students in meaningful inquiry? | Due before 3/28/00. (25)                                             | Response (5) Article Critique (5)                                       | Access educational search engines and resource sites. (25)              | Article #1 Due (50)                                               | Create a "hotlist" of your own educational sites. Due 4/4/00. (100) | 210 |
### Mar 28
- **Reflect on the following FOCUS QUESTIONS**: What are some classroom word processing, spreadsheet, and database activities that lead to more active processing of course content? Describe your experience with word-processing activity.
- **Due before**: 4/4/00.

### Apr 4
- **Read**: 3. Using Instructional Software for Content-Area Learning
- **Reflect on the following FOCUS QUESTIONS**: As a group, discuss strengths and weaknesses of the instructional software you utilized. Summarize your views. Use the Review Summary Sheet and Checklist as a guide.
- **Due before**: 4/11/00.
- **Response**: In groups of 4, rotate through each instructional software (Inspiration Storybook Weaver, KidPix) for 35 minutes. (25)

### Table

<table>
<thead>
<tr>
<th>Due</th>
<th>Read</th>
<th>Reflect on the following FOCUS QUESTIONS</th>
<th>Using &quot;Bulletin Board&quot; Respond to FOCUS QUESTIONS</th>
<th>Save to YOUR Disk</th>
<th>Class Activities</th>
<th>Lesson Plans</th>
<th>Articles</th>
<th>Projects</th>
<th>Total Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mar 28</td>
<td>5. Using Tools: Word Processors, Databases, and Spreadsheets</td>
<td>What are some classroom word processing, spreadsheet, and database activities that lead to more active processing of course content? Describe your experience with word-processing activity.</td>
<td>Due before 4/4/00. (25)</td>
<td>Response (5)</td>
<td>225 pts</td>
<td>90 pts</td>
<td>100 pts</td>
<td>300 pts</td>
<td>1000 pts</td>
</tr>
<tr>
<td>Due</td>
<td>Read</td>
<td>Reflect on the following FOCUS QUESTIONS</td>
<td>Using &quot;Bulletin Board&quot; Respond to FOCUS QUESTIONS 225 pts</td>
<td>Save to YOUR Disk 60 pts</td>
<td>Class Activities 225 pts</td>
<td>Lesson Plans 90 pts</td>
<td>Articles 100 pts</td>
<td>Projects 300 pts</td>
<td>Total Points 1000 pts</td>
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<td>Apr 11</td>
<td>As a group, discuss the strengths and weaknesses of the instructional software you utilized. Summarize your views. Use the Review Summary Sheet and Checklist as a guide.</td>
<td>Due before 4/18/00 (25)</td>
<td>Response (5)</td>
<td>In groups of 4, rotate through each instructional software (Timeliner, Stella Luna, ___) for 30 minutes. (25)</td>
<td>Group ___ Lesson Due. Peer Evaluation Due. (10)</td>
<td>Article #2 due. (50)</td>
<td>115</td>
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</tr>
<tr>
<td>Apr 18</td>
<td>8. Learning to Use Multimedia Tools to Create Multimedia Projects</td>
<td>What is a linear presentation or slide show? What are some examples of assignments that could result in a student-created slide show? What is interactive hypermedia?</td>
<td>Due before 4/25/00. (25)</td>
<td>Response (5) Hyperstudio (5)</td>
<td>Work through Chapters 1, 2, and 3 of Hyperstudio in 1 Hour for group Hyperstudio project. (25)</td>
<td>Group ___ Lesson Due. Peer Evaluation Due. (10)</td>
<td>70</td>
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<tr>
<td>Apr 25</td>
<td>9. Learning to Work with Images and Sound</td>
<td>Why must teachers pay attention to the file format used to store graphic images and sounds?</td>
<td>Due before 5/2/00. (25)</td>
<td>Response (5) Hyperstudio (5)</td>
<td>Work through Chapters 4, 5, and 6 of Hyperstudio in 1 Hour for group Hyperstudio project. (25)</td>
<td>Group ___ Lesson Due. Peer Evaluation Due. (10)</td>
<td>70</td>
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<tr>
<td>Due</td>
<td>Read</td>
<td>Reflect on the following FOCUS QUESTIONS</td>
<td>Using “Bulletin Board” Respond to FOCUS QUESTIONS 225 pts</td>
<td>Save to YOUR Disk 60 pts</td>
<td>Class Activities 225 pts</td>
<td>Lesson Plans 90 pts</td>
<td>Articles 100 pts</td>
<td>Projects 300 pts</td>
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<tr>
<td>May 2</td>
<td>10. Learning from Student Projects: Knowledge as Design and the Design of Hypermedia</td>
<td>What organizational, graphic, text, and interface design principles should you be aware of as you develop hypermedia? Describe your experience with the Hyperstudio activity.</td>
<td>Response (25)</td>
<td>Response (5)</td>
<td>Group Hyperstudio Project (25)</td>
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<tr>
<td>May 9</td>
<td></td>
<td>Describe your overall experiences in this course. Describe what you feel are the effects of this course on your use of technology to support instruction.</td>
<td>Please respond by 5/16/00.</td>
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<td>200</td>
</tr>
</tbody>
</table>

Portfolios and disks will be returned by 5/23/00. Grades: 1000-900=A; 899-800=B; 799-700=C; 699-0=F
APPENDIX C

COMPONENTS AND SEQUENCE OF RESEARCH DESIGN
## COMPONENTS AND SEQUENCE OF RESEARCH DESIGN

<table>
<thead>
<tr>
<th>Date</th>
<th>Event/Activity</th>
<th>Participants</th>
<th>Type of Data</th>
<th>Research Questions</th>
<th>Data Analysis</th>
</tr>
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<tbody>
<tr>
<td>9/99-</td>
<td>Introduction to Technology for</td>
<td>16 PreK-4, 14</td>
<td>lesson plan</td>
<td>1. How do teachers' stages of concerns about technology change after completing ITT</td>
<td>pre-survey, SoCQ, LoU, electronic</td>
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<tr>
<td>12/99</td>
<td>Teachers</td>
<td>MS (7-8), 2</td>
<td>word processing</td>
<td>and AMDT?</td>
<td>correspondence, interviews,</td>
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<tr>
<td></td>
<td></td>
<td>HS (9-12), 2</td>
<td>spreadsheet</td>
<td>2. How do teachers' levels of technology use change after completing ITT and AMDT?</td>
<td>documentation</td>
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<tr>
<td></td>
<td></td>
<td>Adult Educ.,</td>
<td>database</td>
<td>3. Do teachers' changes support the Concerns-Based Adoption Model?</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>3 PC Lab</td>
<td>PowerPoint presentation</td>
<td>4. Do teachers' perceptions of ITT and AMDT experiences support characteristics</td>
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<tr>
<td></td>
<td></td>
<td>Aides, 1</td>
<td>electronic correspondence</td>
<td>of a constructivist approach to professional development?</td>
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<td></td>
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<td>Secretary, 1</td>
<td>digital images</td>
<td>5. How do teachers integrate technology after completing ITT and AMDT?</td>
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<td>Principal, 1</td>
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<td>Parent Center</td>
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<td>40 Total</td>
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<tr>
<td>9/99</td>
<td>Integrating Technology in the</td>
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<td>demographic, i.e. gender, ethnicity,</td>
<td>1. How do teachers' stages of concerns about technology change after completing ITT</td>
<td>pre-survey, SoCQ, LoU, electronic</td>
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<tr>
<td></td>
<td>Schools A Pre-Survey</td>
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<td>years in education, grade/subject</td>
<td>and AMDT?</td>
<td>correspondence, interviews,</td>
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<td></td>
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<td>teaching, certification, highest</td>
<td>2. How do teachers' levels of technology use change after completing ITT and AMDT?</td>
<td>documentation</td>
</tr>
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<td>degree held, self-rated technology</td>
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<td>skill, course expectation(s), access</td>
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<td>to computer, current use(s) of</td>
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<td>technology, current use of software,</td>
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<td>current instructional practices</td>
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<td>9/99</td>
<td>Stages of Concern Questionnaire</td>
<td>32</td>
<td>teachers' attitudes about and</td>
<td>1. How do teachers' stages of concerns about technology change after completing ITT</td>
<td>pre-survey, SoCQ, LoU, electronic</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td>skills associated with technology</td>
<td>and AMDT?</td>
<td>correspondence, interviews,</td>
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<td></td>
<td>3. Do teachers' changes support the Concerns-Based Adoption Model?</td>
<td>observations, member check</td>
</tr>
<tr>
<td>Date</td>
<td>Event/Activity</td>
<td>Participants</td>
<td>Type of Data</td>
<td>Research Questions</td>
<td>Data Analysis</td>
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</tbody>
</table>
| 12/99| Stages of Concern Questionnaire                                               | 32           | teachers' attitudes about and skills associated with technology               | 1. How do teachers' stages of concerns about technology change after completing ITT and AMDT?  
3. Do teachers' changes support the Concerns-Based Adoption Model? | pre-survey, SoCQ, LoU, electronic correspondence, interviews, observations, member check |
| 2/00 | Interview (informal)                                                          | 9 elementary and 9 junior high school teachers | 5 to 10 minutes scheduled recorded interview to ask, "Are you using technology? Identify users and nonusers. " | 1. How do teachers' stages of concerns about technology change after completing ITT and AMDT?  
5. How do teachers integrate technology after completing ITT and AMDT? | pre-survey, SoCQ, member check |
| 2/00 | Level of Use Interview #1 Feb 21-25                                            | 7 elementary and 7 junior high school teachers | 10 minute scheduled, recorded interview to ask about the impact of the course on teaching practices, level of technology use, and concerns about using technology (Why and How) | 1. How do teachers' stages of concerns about technology change after completing ITT and AMDT?  
2. How do teachers' levels of technology use change after completing ITT and AMDT?  
3. Do teachers' changes support the Concerns-Based Adoption Model?  
4. Do teacher perceptions of ITT and AMDT experiences support characteristics of a constructivist approach to professional development?  
5. How do teachers integrate technology after completing ITT and AMDT? | pre-survey, SoCQ, LoU, electronic correspondence, interviews, observations, documentation, member check |
<table>
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<th>Date</th>
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<th>Participants</th>
<th>Type of Data</th>
<th>Research Questions</th>
<th>Data Analysis</th>
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</thead>
</table>
| 3/00-  | Software Applications, Teaching Methods, and Software Development for Teachers | Anticipate 25 to enroll, but only elementary and junior high school teachers participating in case study will be investigated | electronic correspondence, computer logs, portfolio                      | 1. How do teachers' stages of concerns about technology change after completing ITT and AMDT?  
2. How do teachers' levels of technology use change after completing ITT and AMDT?  
3. Do teachers' changes support the Concerns-Based Adoption Model?  
4. Do teacher perceptions of ITT and AMDT experiences support characteristics of a constructivist approach to professional development?  
5. How do teachers integrate technology after completing ITT and AMDT? | pre-survey, SoCQ, LoU, electronic correspondence, interviews, observations, documentation, member check |
| 3/00   | Stages of Concern Questionnaire                                                | 7 elementary and 7 junior high school teachers                                                                        | teachers' attitudes about and skills associated with technology            | 1. How do teachers' stages of concerns about technology change after completing ITT and AMDT?  
3. Do teachers' changes support the Concerns-Based Adoption Model? | pre-survey, ITT SoCQ, LoU, electronic correspondence, interviews, observations, member check |
| 3/00   | Level of Use Interview #2 Mar 6-10                                            | 7 elementary and 7 junior high school teachers                                                                        | 10 minute scheduled, recorded interview to ask about the impact of the course on teaching practices, level of technology use, and concerns about using technology (Why and How) | 1. How do teachers' stages of concerns about technology change after completing ITT and AMDT?  
2. How do teachers' levels of technology use change after completing ITT and AMDT?  
3. Do teachers' changes support the Concerns-Based Adoption Model?  
4. Do teachers' perceptions of ITT and AMDT experiences support characteristics of a constructivist approach to development?  
5. How do teachers integrate technology after completing ITT and AMDT? | pre-survey, SoCQ, LoU, electronic correspondence, interviews, observations, documentation, member check |
<table>
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<tr>
<th>Date</th>
<th>Event/Activity</th>
<th>Participants</th>
<th>Type of Data</th>
<th>Research Questions</th>
<th>Data Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/00</td>
<td>Classroom Observation #1 Mar 6-10</td>
<td>7 elementary and 7 junior high school teachers</td>
<td>15-30 minute scheduled, observation (video), observation log, field notes, and pictures of tech. integration</td>
<td>2. How do teachers' levels of technology use change after completing ITT and AMDT? 5. How do teachers integrate technology after completing ITT and AMDT?</td>
<td>pre-survey, SoCQ, LoU, electronic correspondence, interviews, documentation</td>
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<tr>
<td>4/00</td>
<td>Level of Use Interview #3 Apr 10-14</td>
<td>7 elementary and 7 junior high school teachers</td>
<td>10 minute scheduled, recorded interview to ask about the impact of the course on teaching practices, level of technology use, and concerns about using technology (Why and How)</td>
<td>1. How do teachers' stages of concerns about technology change after completing ITT and AMDT? 2. How do teachers' levels of technology use change after completing ITT and AMDT? 3. Do teachers' changes support the Concerns-Based Adoption Model? 4. Do teacher perceptions of ITT and AMDT experiences support characteristics of constructivist approach to development? 5. How do teachers integrate technology after completing ITT and AMDT?</td>
<td>pre-survey, SoCQ, LoU, electronic correspondence, interviews, observations, documentation, member check</td>
</tr>
<tr>
<td>4/00</td>
<td>Classroom Observation #3 Apr 10-14 #4 Apr 24-28</td>
<td>7 elementary and 7 junior high school teachers</td>
<td>15-30 minute scheduled, observation (video) observation log, field notes, and pictures of technology integration</td>
<td>2. How do teachers' levels of technology use change after completing ITT and AMDT? 5. How do teachers integrate technology after completing ITT and AMDT?</td>
<td>pre-survey, SoCQ, LoU, electronic correspondence, interviews, documentation</td>
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<td>5/00</td>
<td>Level of Use Interview #4 May 8-12</td>
<td>7 elementary and 7 junior high school teachers</td>
<td>10 minute scheduled, recorded interview to ask about the impact of the course on teaching practices, level of technology use, and concerns about using technology (Why and How)</td>
<td>1. How do teachers' stages of concerns about technology change after completing ITT and AMDT? 2. How do teachers' levels of technology use change after completing ITT and AMDT? 3. Do teachers' changes support the Concerns-Based Adoption Model? 4. Do teacher perceptions of ITT and AMDT experiences support characteristics of constructivist approach to development? 5. How do teachers integrate technology after completing ITT and AMDT?</td>
<td>pre-survey, SoCQ, LoU, electronic correspondence, interviews, observations, documentation, member check</td>
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<tr>
<td>Date</td>
<td>Event/Activity</td>
<td>Participants</td>
<td>Type of Data</td>
<td>Research Questions</td>
<td>Data Analysis</td>
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<tr>
<td>5/00</td>
<td>Classroom Observation #5 May 8-12 #6 May 22-26</td>
<td>7 elementary and 7 junior high school teachers</td>
<td>15-30 minute scheduled, observation (video), observation log, field notes, and pictures of technology integration</td>
<td>2. How do teachers’ levels of technology use change after completing ITT and AMDT? 5. How do teachers integrate technology after completing ITT and AMDT?</td>
<td>pre-survey, SoCQ, LoU, electronic correspondence, interviews, documentation</td>
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<tr>
<td>5/00</td>
<td>Stages of Concern Questionnaire</td>
<td>7 elementary and 7 junior high school teachers</td>
<td>teachers’ attitudes about and skills associated with technology</td>
<td>1. How do teachers’ stages of concerns about technology change after completing ITT and AMDT? 3. Do teachers’ changes support the Concerns-Based Adoption Model?</td>
<td>pre-survey, ITT SoCQ, LoU, electronic correspondence, interviews, observations, member check</td>
</tr>
<tr>
<td>6/00</td>
<td>Level of Use Interview #5 6/15/00</td>
<td>7 elementary and 7 junior high school teachers</td>
<td>10 minute scheduled, recorded interview to ask about the impact of the course on teaching practices, level of technology use, and concerns about using technology (Why and How)</td>
<td>1. How do teachers’ stages of concerns about technology change after completing ITT and AMDT? 2. How do teachers’ levels of technology use change after completing ITT and AMDT? 3. Do teachers’ changes support the Concerns-Based Adoption Model? 4. Do teachers’ perceptions of ITT and AMDT experiences support characteristics of a constructivist approach to professional development? 5. How do teachers integrate technology after completing ITT and AMDT?</td>
<td>pre-survey, SoCQ, LoU, electronic correspondence, interviews, observations, documentation, member check</td>
</tr>
</tbody>
</table>
Figure: Hypothesized Development of Stages of Concern

- Nonuser
- Experienced User
- Inexperienced User
- Renewing User

SoC STAGES

RELATIVE INTENSITY

AWARENESS
INFORMATIONAL
PERSONAL
MANAGEMENT
CONSEQUENCE
COLLABORATION
REFOCUSING
APPENDIX E

STAGES OF CONCERN AND INTERVENTATIONS TO FACILITATE CHANGE
# Stages of Concern and Interventions to Facilitate Change

<table>
<thead>
<tr>
<th>Stages of Concern</th>
<th>Interventions to Facilitate Change</th>
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</thead>
<tbody>
<tr>
<td><strong>0 AWARENESS</strong></td>
<td>Involve teachers in discussions and decisions about technology utilization and integration. Share enough information to arouse interest, but not so much that it overwhelms. Acknowledge that a lack of awareness is expected and reasonable, and that no questions about technology are foolish. Encourage unaware teachers to talk with colleagues who know about technology. Take steps to minimize gossip and inaccurate sharing of information about technology utilization and integration.</td>
</tr>
<tr>
<td><strong>1 INFORMATIONAL</strong></td>
<td>Provide clear and accurate information about technology utilization and integration. Use a variety of ways to share information. Communicate with teachers individually and in large and small groups. Have teachers visit other settings where technology has been integrated into the classroom. Conversely, have teachers who have integrated technology into their classrooms visit. Help teachers see how technology relates to their current practices, both in regard to similarities and differences. Be enthusiastic and enhance the visibility of others who are excited.</td>
</tr>
<tr>
<td><strong>2 PERSONAL</strong></td>
<td>Legitimize the existence and expression of personal concerns. Knowing these concerns are common and that other teachers have them can be comforting. Use personal notes and conversations to provide encouragement and to reinforce personal adequacy. Connect these teachers with others whose personal concerns have diminished and who will be supportive. Show how technology can be implemented progressively rather than all at once. Establish expectations that are attainable. Provide encouragement and support while facilitating and sustaining expectations.</td>
</tr>
</tbody>
</table>

Adapted from Hord, Rutherford, Huling-Austin, and Hall, 1987.
<table>
<thead>
<tr>
<th>TASK</th>
<th>Stages of Concern</th>
<th>Interventions to Facilitate Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 MANAGEMENT</td>
<td>Attention is focused on the processes and tasks of using technology and the best use of information and resources. Issues related to efficiency, organizing, managing, scheduling, and time demands are utmost.</td>
<td>Clarify the steps and components of technology integration. Provide answers that address the small specific “how-to” issues that are so often the cause of management concerns. Demonstrate exact and practical solutions to the logistical problems that contribute to these concerns. Help teachers sequence specific activities and set timelines for their accomplishments. Attend to the immediate demands of technology utilization and integration.</td>
</tr>
<tr>
<td>4 CONSEQUENCE</td>
<td>Attention focuses on impact of technology on students in her/his immediate sphere of influence. The focus is on the relevance of technology usage for students, evaluation of student outcomes, including performance and competencies, and changes needed to increase student outcomes.</td>
<td>Provide teachers with opportunities to visit other settings where technology integration is practiced. Conversely, provide opportunities for these teachers to share their skills. Encourage teachers to attend professional development sessions on the topic. Offer positive feedback and needed support.</td>
</tr>
<tr>
<td>5 COLLABORATION</td>
<td>The focus is on coordination and cooperation with others regarding use of technology</td>
<td>Provide teachers with opportunities to develop and use skills necessary for working collaboratively. Help collaborators establish reasonable expectations and guidelines. Have teachers provide technical support to others who need assistance. Encourage collaboration, but do not attempt to force the issue on those who are not interested.</td>
</tr>
<tr>
<td>6 REFOCUSING</td>
<td>The focus is on exploration of more universal benefits from technology, including the possibility of major changes or replacement with a more powerful alternative. Individual has definite ideas about alternatives to the proposed or existing form of utilization and integration of technology.</td>
<td>Respect and encourage the interest teachers have for finding a better way. Help teachers channel their ideas and energies in ways that will be productive rather than counterproductive. Encourage teachers to act on their concerns for program improvement. Help teachers access the resources they may need to refine their ideas and put them into practice. Be aware of and willing to accept the fact that teachers may replace or significantly modify the existing utilization and integration of technology.</td>
</tr>
</tbody>
</table>

Adapted from Hord, Rutherford, Huling-Austin, and Hall, 1987
Stages of Concern Questionnaire

The purpose of this questionnaire is to determine what people who are using or thinking about using technology are concerned about at various times during the school year. The items were developed from typical responses of school and college teachers who ranged from no knowledge at all about technology to many years of experience in it. Therefore, a good part of the items may 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:

0 1 2 3 4 5 6 7 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.

Please, respond to the items in terms of your present concerns, or how you feel about your involvement or potential involvement with technology. We do not hold to any one definition of technology, so please think of it in terms of your own perception.

Thank you for taking time to complete this task.

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<th>5</th>
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<tbody>
<tr>
<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>
<td></td>
</tr>
<tr>
<td>0 1 2 3 4 5 6 7</td>
<td>I am concerned about students' attitudes toward technology.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 1 2 3 4 5 6 7</td>
<td>I now know of some other approaches that might work better.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 1 2 3 4 5 6 7</td>
<td>I don't even know what technology is.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 1 2 3 4 5 6 7</td>
<td>I am concerned about not having enough time to organize myself each day.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 1 2 3 4 5 6 7</td>
<td>I would like to help other faculty in their use of technology.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 1 2 3 4 5 6 7</td>
<td>I have a very limited knowledge about technology.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 2 3 4 5 6 7</td>
<td>I would like to know the effect of technology on my professional status.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
Not true of me now | Somewhat true of me now | Very true of me now
---|---|---
0 | 1 | 2 | 3 | 4 | 5 | 6 | 7

0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 I am concerned about the conflict between my interests and my responsibilities.

0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 I am concerned about revising my use of technology.

0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 I would like to develop working relationships with both our faculty and outside faculty using technology.

0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 I am concerned about how technology affects students.

0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 I am not concerned about technology.

0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 I would like to know who will make the decisions about technology.

0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 I would like to discuss the possibility of using technology.

0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 I would like to know what resources are available if we decide to adopt technology.

0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 I am concerned about my inability to manage all that technology requires.

0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 I would like to know how my teaching or administration is supposed to change.

0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 I would like to familiarize other departments or persons with the progress of technology.

0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 I am concerned about evaluating my impact on students.

0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 I would like to revise technology's instructional approach.

0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 I am completely occupied with other things.

0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 I would like to modify our use of technology based on the experiences of our students.

0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 Although I don't know about technology, I am concerned about things in the area.

0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 I would like to excite my students about their part in technology.

0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 I am concerned about the time spent working with nonacademic problems related to technology.

0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 I would like to know what the use of technology will require in the immediate future.
<table>
<thead>
<tr>
<th>Scale</th>
<th>Description</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Not true of me now</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>1</td>
<td>I would like to coordinate my effort with others to maximize technology's effects.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>2</td>
<td>I would like to have more information on time and energy commitments required by technology.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>3</td>
<td>I would like to know what other faculty are doing in this area.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>4</td>
<td>At this time, I am not interested in learning about technology.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>5</td>
<td>I would like to determine how to supplement, enhance, or replace technology.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>6</td>
<td>I would like to use feedback from the students to change the use of technology.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>7</td>
<td>I would like to know how my role will change when I am using technology.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>8</td>
<td>Coordination of tasks and people is taking too much of my time.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>9</td>
<td>I would like to know how technology is better than what we have now.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
</tbody>
</table>

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Procedures for Adopting Educational Innovations/CEAM Project
R&D Center for Teacher Education, The University of Texas at Austin
APPENDIX G

LEVELS OF USE INTERVIEW QUESTIONS
**Figure 4: Interview Questions**

<table>
<thead>
<tr>
<th>Question</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are you using the innovation?</td>
<td>To distinguish between users and nonusers; to break LoU 0-II from LoU III-VI.</td>
</tr>
<tr>
<td>What do you see as the strengths and weaknesses of the innovation in your situation? Have you made any attempt to do anything about the weaknesses?</td>
<td></td>
</tr>
<tr>
<td>Are you currently looking for any information about the innovation? What kind? For what purpose?</td>
<td></td>
</tr>
<tr>
<td>Do you ever talk with others about the innovation? What do you tell them?</td>
<td></td>
</tr>
<tr>
<td>What do you see as being the effects of the innovation? In what way have you determined this? Are you doing any evaluating, either formally or informally, of your use of the innovation? Have you received any feedback from students? What you have done with the information you get?</td>
<td>To probe Assessing and Knowledge categories.</td>
</tr>
<tr>
<td>Have you made any changes recently in how you use the innovation? What? Why? How recently? Are you considering making any changes?</td>
<td>To probe Acquiring Information category.</td>
</tr>
<tr>
<td>As you look ahead to later this year, what plans do you have in relation to your use of the innovation?</td>
<td>To probe Sharing category.</td>
</tr>
<tr>
<td></td>
<td>To probe Assessing category.</td>
</tr>
<tr>
<td></td>
<td>To distinguish between LoU III (user-oriented changes), LoU IV B (student-oriented changes) and LoU IV A (no or routine changes); to probe Status Reporting and Performing categories.</td>
</tr>
</tbody>
</table>
### Figure 4 (continued)

<table>
<thead>
<tr>
<th>Question</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are you working with others (outside of anyone you may have worked with from the beginning) in your use of the innovation? Have you made any changes in your use of the innovation based on this coordination?</td>
<td>To separate LoU V from III, IV A and IV B. If a positive response is given, LoU V probes (below) are used.</td>
</tr>
<tr>
<td>Are you considering or planning to make major modifications or to replace the innovation at this time?</td>
<td>To separate LoU VI from III, IV A, IV B and V.</td>
</tr>
<tr>
<td>How do you work together? How frequently?</td>
<td>LoU V Probes</td>
</tr>
<tr>
<td>What do you see as the strengths and the weaknesses of this collaboration?</td>
<td></td>
</tr>
<tr>
<td>Are you looking for any particular kind of information in relation to this collaboration?</td>
<td></td>
</tr>
<tr>
<td>When you talk to others about your collaboration, what do you share with them?</td>
<td></td>
</tr>
<tr>
<td>Have you done any formal or informal evaluation of how your collaboration is working?</td>
<td></td>
</tr>
<tr>
<td>What plans do you have for this collaborative effort in the future?</td>
<td></td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Question</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Have you made a decision to use the innovation in the future? If so, when?</td>
<td>To separate LoU 0 from I; to probe Status Reporting, Planning and Performing categories. To separate LoU I from II.</td>
</tr>
<tr>
<td>Can you describe the innovation for me as you see it?</td>
<td>To probe Knowledge category.</td>
</tr>
<tr>
<td>Are you currently looking for any information about the innovation?</td>
<td>To probe Acquiring Information category.</td>
</tr>
<tr>
<td>What do you see as the strengths and weaknesses of the innovation for your situation?</td>
<td>To probe Assessing, Sharing and Status Reporting categories.</td>
</tr>
<tr>
<td>At this point in time, what kinds of questions are you asking about the innovation? Give examples if possible.</td>
<td>To probe Sharing category.</td>
</tr>
<tr>
<td>Do you ever talk with others and share information about the innovation? What do you share?</td>
<td>To probe Planning category.</td>
</tr>
<tr>
<td>What are you planning with respect to the innovation? Can you tell me about any preparation or plans you have been making for the use of the innovation?</td>
<td>To get a concise picture of the user's perception of his/her use or nonuse.</td>
</tr>
<tr>
<td>Can you summarize for me where you see yourself right now in relation to the use of the innovation? (Optional Question)</td>
<td></td>
</tr>
</tbody>
</table>

Figure 4 (continued)
<table>
<thead>
<tr>
<th>Question</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Why did you stop using the innovation?</td>
<td></td>
</tr>
<tr>
<td>Can you describe for me how you organized your use of the innovation,</td>
<td></td>
</tr>
<tr>
<td>what problems you found, what its effects appeared to be on students?</td>
<td></td>
</tr>
<tr>
<td>When you assess the innovation at this point in time, what do you</td>
<td></td>
</tr>
<tr>
<td>see as the strengths and weaknesses for you?</td>
<td></td>
</tr>
</tbody>
</table>
Overview of Branching Format of the LoU Interview
APPENDIX H

LEVELS OF USE AND CATEGORIES
LEVELS OF USE

<table>
<thead>
<tr>
<th>Scale Point Definitions of the Levels of Use of the Innovation</th>
</tr>
</thead>
<tbody>
<tr>
<td>KNOWLEDGE</td>
</tr>
<tr>
<td>That which the user knows about characteristics of the innovation, how to use it, and consequences of its use.</td>
</tr>
</tbody>
</table>

**LEVELS OF USE**

**LEVEL 9**

**Knowledge State** in which the user has some or no awareness of the innovation, its environment with the organization, and is using random sampling to discover others in the same category.

**DECISION POINT A**

Takes action to learn more about the innovation.

**LEVEL 1**

**Knowledge State** in which the user has reviewed or is acquiring information about the innovation and/or his environment with the organization, and is using sampling techniques to identify others.

**DECISION POINT B**

Makes a decision to use the innovation by exchanging a user of degree.

**LEVEL 2**

**Preparation State** in which the user is preparing for first use of the innovation.

**DECISION POINT C**

Seeks first use of the innovation.

**LEVEL 3**

**Mechanical Use**—User is aware of the innovation, is using the innovation on a day-to-day basis, has engaged in a preparatory process to use the innovation with minimum effort and stress. Knowledge and understanding about the innovation are at a maximum density. User makes minimal adjustments to the innovation during use.

**DECISION POINT D**

Uses the innovation with ease.

**LEVEL 4 A**

**Routine Use** of the innovation by a user who has substantial use of the innovation with minimal effort and stress. The user has made minimal adjustments to the innovation during use of the innovation. User makes frequent and substantial modifications to the innovation during use.

**DECISION POINT D-1**

Uses the innovation with minimal or no effort.

**LEVEL 4 B**

**Refinement State** in which the user improves the use of the innovation by frequent and substantial modifications to the innovation. User makes frequent and substantial modifications to the innovation during use of the innovation.

**DECISION POINT E**

Seeks improvement and modification of the innovation in a variety of ways, including observing resources people, corresponding with resource agents, reviewing printed materials, and making visits.

**LEVEL 5**

**Integration State** in which the user improves the use of the innovation by frequent and substantial modifications to the innovation in a variety of ways, including observing resources people, corresponding with resource agents, reviewing printed materials, and making visits.

**DECISION POINT F**

Seeks improvement and modification of the innovation in a variety of ways, including observing resources people, corresponding with resource agents, reviewing printed materials, and making visits.

**LEVEL VI**

**Renewal State** in which the user reviews the use of the innovation by frequent and substantial modifications to the innovation in a variety of ways, including observing resources people, corresponding with resource agents, reviewing printed materials, and making visits.

**DECISION POINT G**

Seeks improvement and modification of the innovation in a variety of ways, including observing resources people, corresponding with resource agents, reviewing printed materials, and making visits.

<table>
<thead>
<tr>
<th>CATEGORIES</th>
<th>ASSESSING</th>
<th>PLANNING</th>
<th>STATUS REPORTING</th>
<th>PERFORMING</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assessing</strong></td>
<td>Examines the potential or actual use of the innovation or some aspect of it. This can be a mental assessment or can involve actual observation and analysis of data.</td>
<td>Designs and outlines short- and/or long-range steps to be taken during implementation of the innovation, including resources, schedules, activities, and outcomes associated with the implementation.</td>
<td>Describes personal stand at the present time in relation to use of the innovation.</td>
<td>Carries out the actions and activities outlined in operationalizing the innovation.</td>
</tr>
<tr>
<td></td>
<td>Takes no action in analyzing the innovation, scheduled use, or consequences of use.</td>
<td>Schedules no time and specifies no items for the study or use of the innovation.</td>
<td>Reports little or no personal involvement with the innovation.</td>
<td>Takes no discernible action toward learning about or using the innovation. The involvement and/or of its consequences are not present or in use.</td>
</tr>
<tr>
<td><strong>Analysis and Comparison</strong></td>
<td>Identifies issues and procedures involved in planning resources and organizing activities and events for initial use of the innovation.</td>
<td>Plans for ongoing and managing resources, activities, and events related primarily to immediate ongoing use of the innovation. Managerial changes address managerial or managerial issues with a short-term perspective.</td>
<td>Reports that agencies, individuals, management, resources, organization, etc., are the topic of most personal efforts in use of the innovation.</td>
<td>Expresses the innovation and requirements for it use by taking in others about it, reviewing descriptive information and samples materials, planning organizational sessions, and selecting others using it.</td>
</tr>
<tr>
<td><strong>Assessing own use of the innovation and related to present or future use.</strong></td>
<td>Identifies issues and procedures involved in planning resources and organizing activities and events for initial use of the innovation.</td>
<td>Plans for ongoing and managing resources, activities, and events related primarily to immediate ongoing use of the innovation. Managerial changes address managerial or managerial issues with a short-term perspective.</td>
<td>Reports that agencies, individuals, management, resources, organization, etc., are the topic of most personal efforts in use of the innovation.</td>
<td>Expresses the innovation and requirements for it use by taking in others about it, reviewing descriptive information and samples materials, planning organizational sessions, and selecting others using it.</td>
</tr>
<tr>
<td><strong>Assessment of innovation to those activities and procedures involved in implementation in terms of current practice to improve current outcomes.</strong></td>
<td>Identifies issues and procedures involved in planning resources and organizing activities and events for initial use of the innovation.</td>
<td>Plans for ongoing and managing resources, activities, and events related primarily to immediate ongoing use of the innovation. Managerial changes address managerial or managerial issues with a short-term perspective.</td>
<td>Reports that agencies, individuals, management, resources, organization, etc., are the topic of most personal efforts in use of the innovation.</td>
<td>Expresses the innovation and requirements for it use by taking in others about it, reviewing descriptive information and samples materials, planning organizational sessions, and selecting others using it.</td>
</tr>
<tr>
<td><strong>Assessment of use of the innovation for the purpose of current practice and to improve current outcomes.</strong></td>
<td>Identifies issues and procedures involved in planning resources and organizing activities and events for initial use of the innovation.</td>
<td>Plans for ongoing and managing resources, activities, and events related primarily to immediate ongoing use of the innovation. Managerial changes address managerial or managerial issues with a short-term perspective.</td>
<td>Reports that agencies, individuals, management, resources, organization, etc., are the topic of most personal efforts in use of the innovation.</td>
<td>Expresses the innovation and requirements for it use by taking in others about it, reviewing descriptive information and samples materials, planning organizational sessions, and selecting others using it.</td>
</tr>
<tr>
<td><strong>Assessment of current practice in terms of current practice and to improve current outcomes.</strong></td>
<td>Identifies issues and procedures involved in planning resources and organizing activities and events for initial use of the innovation.</td>
<td>Plans for ongoing and managing resources, activities, and events related primarily to immediate ongoing use of the innovation. Managerial changes address managerial or managerial issues with a short-term perspective.</td>
<td>Reports that agencies, individuals, management, resources, organization, etc., are the topic of most personal efforts in use of the innovation.</td>
<td>Expresses the innovation and requirements for it use by taking in others about it, reviewing descriptive information and samples materials, planning organizational sessions, and selecting others using it.</td>
</tr>
<tr>
<td><strong>Assessment of effectiveness in terms of current practice and to improve current outcomes.</strong></td>
<td>Identifies issues and procedures involved in planning resources and organizing activities and events for initial use of the innovation.</td>
<td>Plans for ongoing and managing resources, activities, and events related primarily to immediate ongoing use of the innovation. Managerial changes address managerial or managerial issues with a short-term perspective.</td>
<td>Reports that agencies, individuals, management, resources, organization, etc., are the topic of most personal efforts in use of the innovation.</td>
<td>Expresses the innovation and requirements for it use by taking in others about it, reviewing descriptive information and samples materials, planning organizational sessions, and selecting others using it.</td>
</tr>
<tr>
<td><strong>Assessment of current practice in terms of current practice and to improve current outcomes.</strong></td>
<td>Identifies issues and procedures involved in planning resources and organizing activities and events for initial use of the innovation.</td>
<td>Plans for ongoing and managing resources, activities, and events related primarily to immediate ongoing use of the innovation. Managerial changes address managerial or managerial issues with a short-term perspective.</td>
<td>Reports that agencies, individuals, management, resources, organization, etc., are the topic of most personal efforts in use of the innovation.</td>
<td>Expresses the innovation and requirements for it use by taking in others about it, reviewing descriptive information and samples materials, planning organizational sessions, and selecting others using it.</td>
</tr>
</tbody>
</table>

**LTO: A FRAMEWORK FOR ANALYZING INNOVATION ADOPTION**
APPENDIX I

INTEGRATING TECHNOLOGY IN THE SCHOOLS – A PRESURVEY
### Integrating Technology in the Schools – A Presurvey

<table>
<thead>
<tr>
<th>Last four digits of your SSN#</th>
<th>Years in Education</th>
<th>Grade/Subject</th>
</tr>
</thead>
<tbody>
<tr>
<td>Certification</td>
<td>Highest Degree</td>
<td></td>
</tr>
</tbody>
</table>

1. What type(s) of technology do you currently use in your classroom? List the daily usage percentage to all that apply.

<table>
<thead>
<tr>
<th>Technology</th>
<th>Daily Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Video, TV</td>
<td></td>
</tr>
<tr>
<td>Computer(s)</td>
<td></td>
</tr>
<tr>
<td>Overhead Projector</td>
<td></td>
</tr>
<tr>
<td>Filmstrips or Slides</td>
<td></td>
</tr>
<tr>
<td>Multimedia Presentations</td>
<td></td>
</tr>
<tr>
<td>Graphing Calculators</td>
<td></td>
</tr>
<tr>
<td>Telecommunications</td>
<td></td>
</tr>
<tr>
<td>Others, please specify</td>
<td></td>
</tr>
</tbody>
</table>

2. What do you expect to learn from this course?

3. What type of computer do you use? At home? At school?

4. Rate your proficiency for using computers? Circle one.

<table>
<thead>
<tr>
<th>0 - None</th>
<th>1 - Minimally</th>
<th>2 - Comfortably</th>
<th>3 - Confidently</th>
<th>4 - Proficiently</th>
</tr>
</thead>
</table>

5. What type(s) of software do you use at home or school? Circle all that apply.

<table>
<thead>
<tr>
<th>Word Processing</th>
<th>Presentation</th>
<th>Computer-Assisted Instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spreadsheet</td>
<td>Multimedia</td>
<td>Database</td>
</tr>
<tr>
<td>Other, please specify</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6. What type(s) of instructional practices do you currently use in your classroom? List the daily usage percentage to all that apply.

<table>
<thead>
<tr>
<th>Instructional Practices</th>
<th>Daily Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher-Centered</td>
<td></td>
</tr>
<tr>
<td>Learner-Centered</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Instructional Strategies</th>
<th>Daily Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology Integration</td>
<td></td>
</tr>
<tr>
<td>Interdisciplinary</td>
<td></td>
</tr>
<tr>
<td>Performance Assessment</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX J

ELECTRONIC BULLETIN BOARD
Current Messages

Currently 410 total messages in 47 threads.
Now displaying all messages.

- Answer to question #7 - Rita M. House, 05/11/00 - 22:48:41
- Answer to question #7 - Rita M. House, 05/11/00 - 22:46:37
- Question #7 - Rita M. House, 05/11/00 - 22:21:04
- Answer to question #6 - Rita M. House, 05/10/00 - 16:03:40
- Answer to question about linear presentations - Rita M. House, 05/08/00 - 22:13:11
- Question 7 - Dawn Basinger, 05/05/00 - 16:47:39
  - Answer to Question #7 - Myrna Thomas, 05/15/00 - 10:14:15
  - Response to Question 7 - Daryl M. Savage, 05/11/00 - 21:34:28
  - Response to Question 7 - Lorie Harper, 05/10/00 - 11:26:44
  - Response to Question 7 - Pam Prince, 05/10/00 - 08:55:07
- response #7 - Kathy Johnston, 05/10/00 - 07:37:09
- Question #7 - Monica D. Moore, 05/10/00 - 05:55:32
- answer question 7 - caroll ann odom, 05/09/00 - 11:28:25
- Question #7 Response - Twyla Hilton, 05/09/00 - 10:23:03
- Q 7 resp - Ashley Henry, 05/09/00 - 08:49:22
- Question 7 - Claudia Simpson, 05/07/00 - 20:54:34
- Answer to Question 7 - Sandra Langley, 05/06/00 - 21:54:44
- Response To question 7 - Amanda Thomas, 05/06/00 - 00:01:47
- Answer to question #4 - Rita M. House, 05/02/00 - 18:49:24
- Question 6 - Dawn Basinger, 04/25/00 - 08:58:14
  - Response #6 - Kathy Johnston, 05/03/00 - 16:32:21
  - Response to question 6 - Monica Moore, 05/03/00 -
Bulletin Board Responses

Jan 2000 Are you using technology? Explain. What do you see as the strengths and weaknesses of using technology in your situation? What do you see as being the effects of using technology?

Question 1. (Chapter I) Consider how technology has influenced you as a learner or student and as a teacher.

Question 2. (Chapter 2) Think about and describe an authentic activity that your students could experience. Was this activity the same one you developed for your students to use with one computer? If not, describe the one computer activity. Describe your experience with the database activity. Describe the strengths and weaknesses.

Question 3. (Chapter 6) With so many resources available on the www, how can teachers structure web projects to engage students in meaningful inquiry?
Be sure to check out the following websites:
http://edweb.sdsu.edu/webquest/webquest.html
http://www.kn.pacbell.com/wired/fil
If you have questions or encounter any problems, please e-mail me! Thanks.

Question 4. (Chapter 5) What are some classroom word processing, spreadsheet, and database activities that lead to more active processing of course content?

Question 5. (Chapter 3) Discuss the strengths and weaknesses of the instructional software you evaluated. Did the software contain the four stages of instruction?

Project 1. Please describe the computer activity that you are developing for use in your classroom to support instruction. Originally, groups were to select a lesson from the ISTE NETS Connecting Curriculum and Technology text and teach it to a class as well as to our class. Well, some felt that they were too long or were not applicable to their instructional needs. Therefore, groups or individuals were to develop their own computer activity using an application from Office 97 or other applications (educational software or Internet) to use. I want to know what progress you are making. When will you be ready to deliver this to our class? To your class?

Case Study Teachers. The first classroom observations begin this week and continue through April 26th. If you haven’t scheduled a time, please do so now. Don’t forget to turn in your computer logs!

Question 6. A. What is a linear presentation or slide show? B. What is interactive hypermedia? C. Give an example of each (both A and B) that could result in a teacher-created project. D. Give an example of each (both A and B) that could result in a student-created project.

Question 7. A. What do you think about HyperStudio? Describe the program’s strengths, weaknesses, and classroom utility. B. For many of you, it was the first time to use a computer to support instruction. Describe your instructional experience (how long it took you to plan for the instruction, how well it went instructionally, and how did the students react). C. How has this course had an impact on you personally and professionally? I ENJOYED MY TIME WITH EACH AND EVERY ONE OF YOU THIS QUARTER. A SPECIAL THANK YOU FOR SHARING HOW TECHNOLOGY HAS HAD AN IMPACT ON YOU.
APPENDIX K

OBSERVATION LOG
### Observation Log

<table>
<thead>
<tr>
<th></th>
<th>#1 Mar 6-10</th>
<th>#2 Mar 20-24</th>
<th>#3 Apr 3-7</th>
<th>#4 Apr 17-21</th>
<th>#5 May 1-5</th>
<th>#5 May 15-19</th>
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<td># in class</td>
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<td></td>
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<tr>
<td>Grade</td>
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<td>Subject</td>
<td>Interdisciplinary?</td>
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### Instructional Practices

<table>
<thead>
<tr>
<th>Teacher-Centered facts, rules, and action sequences</th>
<th>Student-Centered concepts, patterns, and abstractions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Begins the lesson with a review of the previous day's work.</td>
<td>Begins the lesson with advance organizers that provide an overall picture and that allow for concept expansion.</td>
</tr>
<tr>
<td>Presents new content in small steps with explanations and examples.</td>
<td>Focuses student responses using induction and/or deduction to refine and focus generalizations.</td>
</tr>
<tr>
<td>Provides an opportunity for guided practice on a small number of sample problems. Prompts and models when necessary to attain accuracy.</td>
<td>Presents examples and nonexamples of the generalization identifying critical and noncritical attributes.</td>
</tr>
<tr>
<td>Provides feedback and corrections according to whether the answer was correct, quick, and firm; correct, but hesitant; careless; or incorrect.</td>
<td>Draws additional examples from students' own experiences, interests, and problems.</td>
</tr>
<tr>
<td>Provides an opportunity for independent practice with seatwork. Strives for automatic responses that are exact.</td>
<td>Uses questions to guide discovery and articulation of the generalization.</td>
</tr>
<tr>
<td>Provides weekly and monthly (cumulative) reviews and reteaches unlearned content.</td>
<td>Involves students in evaluating their own responses.</td>
</tr>
<tr>
<td>lecture-recitation, worksheets, tutoring, guided practice, objective and essay tests</td>
<td>direct experiences, group investigation, in-depth study, higher-order thinking, authentic/performance assessment</td>
</tr>
</tbody>
</table>

Adapted from Borich, G. (1996) Effective Teaching Methods

### Technology Used and/or Available but Not Used

<table>
<thead>
<tr>
<th>Computer</th>
<th>Printer</th>
<th>Internet</th>
<th>Email</th>
<th>Word Processor</th>
<th>Database</th>
<th>Spreadsheet</th>
<th>Presentation</th>
<th>Graphics</th>
<th>Multimedia</th>
<th>Content</th>
<th>Software</th>
<th>Overhead Projector</th>
<th>TV</th>
<th>Video</th>
<th>Filmstrip or Slides</th>
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### Concerns:


### Behaviors:


### Basinger
APPENDIX L

COMPUTER USAGE LOG
**COMPUTER USAGE LOG**

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<tr>
<th>Date</th>
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<th>Home or School</th>
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<th>Hours</th>
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</tbody>
</table>

Concerns: ___________________________________________________________

_____________________________________________________

_______________________ ID#  
For Week of __________________________
APPENDIX M

HUMAN USE COMMITTEE REVIEW
TO: Dawn Basinger  
FROM: Deby Hamm, Graduate School  
SUBJECT: HUMAN USE COMMITTEE REVIEW  
DATE: November 8, 1999  

In order to facilitate your project, an EXPEDITED REVIEW has been done for your proposed study entitled:

"Teachers' perceptions on the utilization and integration of technology in the classroom and the implications"
Proposal # 1-RA

The proposed study procedures were found to provide reasonable and adequate safeguards against possible risks involving human subjects. The information to be collected may be personal in nature or implication. Therefore, diligent care needs to be taken to protect the privacy of the participants and to assure that the data are kept confidential. Further, the subjects must be informed that their participation is voluntary.

Since your reviewed project appears to do no damage to the participants, the Human Use Committee grants approval of the involvement of human subjects as outlined.

You are requested to maintain written records of your procedures, data collected, and subjects involved. These records will need to be available upon request during the conduct of the study and retained by the university for three years after the conclusion of the study.

If you have any questions, please give me a call at 257-2924.
STUDY/PROJECT INFORMATION FOR HUMAN SUBJECTS COMMITTEE

TITLE: Teachers' perceptions on the utilization and integration of technology in the classroom and the implications.

PROJECT DIRECTOR: Dawn Basinger
COMMITTEE: Dr. Carolyn Talton, Dr. Nan McJamerson, Dr. Glenda Holland, Dr. Bonnie Johnson, and Dr. Dale Johnson

DEPARTMENT: Curriculum & Instruction

PURPOSE OF STUDY/PROJECT: As part of my dissertation study, quantitative and qualitative data on teachers' perceptions on the utilization and integration of technology in the classroom will be collected. Data will investigate teachers' levels of concern toward technology and their integrated software (word processing, spreadsheet, database, and presentation) skill and application. Data will also study the following questions: (1) How do my perceptions on the utilization and integration of technology as an educational technology instructor in a beginning educational technology course compare with teachers' perceptions? (2) How do teachers initially use and integrate technology in the classroom after instruction? (3) How do teachers perceive the overall effect of technology for personal and professional use after instruction? Implications from findings will offer further understanding for other educational technology instructors and classroom teachers utilizing and integrating technology in the classroom.

SUBJECTS: In-service teachers enrolled in Louisiana Tech University's Fall 1999 Quarter extension course of Introduction to Technology for Teachers.

PROCEDURE: Approximately 35 teachers from two North Louisiana Parishes will voluntarily complete self-report instruments while participating in a beginning educational technology course. Upon completion of the course, approximately fifteen elementary teachers will volunteer to be observed in their classrooms for technology usage and integration. They will maintain a weekly journal to reflect upon technology usage and integration, be interviewed in person and via e-mail, and meet as a group once a month to share their experiences with the other teacher participants. Field notes and a reflective journal will also be kept by researcher. All information will be held confidential.

INSTRUMENTS AND MEASURES TO INSURE PROTECTION OF CONFIDENTIALITY, ANONYMITY: The 35 item CBAM Inventory developed by R&D Center for Teacher Education, The University of Texas at Austin (1974) will be used to investigate levels of technology concern. An instrument developed by Hall and George (1979) and Sprague (1995), Innovation with the use of Technology by Stages, will be used to assess levels of concern. A brief self-report instrument with objectives developed by the researcher and rating scale developed by Louisiana INTECH will be used to analyze Pre-Post integrated software (word processing, spreadsheet, database, and presentation) skill and application.
presentation) skills. An instrument developed by the researcher will be used to gather demographic information and additional technology characteristics. All collected information will be held confidential and only viewed by the researcher and committee.

RISKS/ALTERNATIVE TREATMENTS: There are no risks associated with participation in this study. It requires completion of instruments mentioned above. There are no alternative treatments. Participation is voluntary.

BENEFITS/COMPENSATION: None.

SAFEGUARDS OF PHYSICAL AND EMOTIONAL WELL-BEING: This study involves no treatment or physical contact. All information collected will be held strictly confidential. No one will be allowed access to the data other than the researcher and committee.
HUMAN SUBJECTS CONSENT FORM

TITLE OF PROJECT: Teachers' perceptions on the utilization and integration of technology in the classroom and the implications.

PURPOSE OF STUDY/PROJECT: As part of my dissertation study, quantitative and qualitative data on teachers' perceptions on the utilization and integration of technology in the classroom will be collected. Data will investigate teachers' levels of concern toward technology and their integrated software (word processing, spreadsheet, database, and presentation) skill and application. Data will also study the following questions: (1) How do my perceptions on the utilization and integration of technology as an educational technology instructor in a beginning educational technology course compare with teachers' perceptions? (2) How do teachers initially use and integrate technology in the classroom after instruction? (3) How do teachers' perceive the overall effect of technology for personal and professional use after instruction? Implications from findings will offer further understanding for other educational technology instructors and classroom teachers utilizing and integrating technology in the classroom.

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INSTRUMENTS: The 35 item CBAM Inventory developed by R&D Center for Teacher Education, The University of Texas at Austin (1974) will be used to investigate levels of technology concern. An instrument developed by Hall and George (1979) and Sprague (1995), Innovation with the use of Technology by Stages, will be used to assess levels of concern. A brief self-report instrument with objectives developed by the researcher and rating scale developed by Louisiana INTECH will be used to collect Pre-Post integrated software (word processing, spreadsheet, database, and presentation) skills. An instrument developed by the researcher will be used to gather demographic information and additional technology characteristics. All collected information will be held confidential and only viewed by the researcher and committee.

RISKS/ALTERNATIVE TREATMENTS: There are no risks associated with participation in this study. It requires completion of instruments mentioned above. There are no alternative treatments. Participation is voluntary.

BENEFITS/COMPENSATION: None.
I, ______________________________, attest with my signature that I have read and understood the following description of the study, "Teachers' perceptions on the utilization and integration of technology in the classroom and the implications", and its purposes and methods. I understand that my participation in this research is strictly voluntary and my participation or refusal to participate in this study will not affect my relationship with Louisiana Tech University or my grades in any way. While some of these activities may be required for the course, the inclusion or decision not to include my responses in the study is my choice and will not change my grade. Further, I understand that I may withdraw at any time or refuse to answer any questions without penalty. Upon completion of the study, I understand that the results will be freely available to me upon request. I understand that the results of my survey will be confidential, accessible only to the principal investigators, myself, or a legally appointed representative. I have not been requested to waive nor do I waive any of my rights related to participating in this study.

Signature of Participant ______________________________ Date __________

CONTACT INFORMATION: The principal researchers listed below may be reached to answer questions about the research, subjects' rights, or related matters.

Dawn Basinger (257-2794) or Dr. Carolyn Talton (257-2794)

Members of the Human Use Committee of Louisiana Tech University may also be contacted if a problem cannot be discussed with the experimenters:

Dr. Terry McConathy (257-2794), Dr. Mary Livingston (257-4315), or Mrs. Deby Hamm (257-2924)
APPENDIX N

SoCQ QUICK-SCORING DEVICE
### ScCQ Quick Scoring Device

#### Part A

**DATE:**

**SITE:**

**SSM:**

**INNOVATION:**

#### Part B

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#### Part C

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#### Part D

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#### Part E

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#### Part F

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#### Part G

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- [ ]
- [ ]

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APPENDIX O

LEVEL OF USE RATING SHEET
LEVEL OF USE RATING SHEET (CBAM, 1975)

<table>
<thead>
<tr>
<th>Level</th>
<th>Knowledge</th>
<th>Acquiring Information</th>
<th>Sharing</th>
<th>Assessing</th>
<th>Planning</th>
<th>Status Reporting</th>
<th>Performing</th>
<th>Overall LoU</th>
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</table>

User is not doing: ND ND ND ND ND ND ND ND

No Information in Interview: NI NI NI NI NI NI NI NI

Is the individual a past user? Yes No

How much difficulty did you have in assigning this person to a specific LoU? None 1 2 3 4 5 6 7 Very much

Comments about interviewer --

General Comments --
APPENDIX P

STANDARDS FOR BASIC ENDORSEMENT IN
EDUCATIONAL COMPUTING AND
TECHNOLOGY LITERACY
1.0 Prerequisite Preparation—Foundations.

Professional studies culminating in the educational computing and technology literacy endorsement prepare candidates to use computers and related technologies in educational settings. All candidates seeking initial certification or endorsements in teacher preparation programs should have opportunities to meet the educational technology foundations standards.

1.1 Basic Computer/Technology Operations and Concepts.

Candidates will use computer systems-run software; to access, generate, and manipulate data; and to publish results. They will also evaluate performance of hardware and software components of computer systems and apply basic troubleshooting strategies as needed.

1.1.1 operate a multimedia computer system with related peripheral devices to successfully install and use a variety of software package.
1.1.2 use terminology related to computers and technology appropriately in written and oral communications.
1.1.3 describe and implement basic troubleshooting techniques for multimedia computer systems with related peripheral devices.
1.1.4 use imaging devices such as scanners, digital cameras, and/or video cameras with computer systems and software.
1.1.5 demonstrate knowledge of uses of computers and technology in business, industry, and society.

1.2 Personal and Professional Use of Technology.
Candidates will apply tools for enhancing their own professional growth and productivity. They will use technology in communicating, collaborating, conducting research, and solving problems. In addition, they will plan and participate in activities that encourage lifelong learning and will promote equitable, ethical, and legal use of computer/technology resources.

1.2.1 use productivity tools for word processing, database management, and spreadsheet applications.

1.2.2 apply productivity tools for creating multimedia presentations.

1.2.3 use computer-based technologies including telecommunications to access information and enhance personal and professional productivity.

1.2.4 use computers to support problem solving, data collection, information management, communications, presentations, and decision making.

1.2.5 demonstrate awareness of resources for adaptive assistive devices for student with special needs.

1.2.6 demonstrate knowledge of equity, ethics, legal, and human issues concerning use of computers and technology.

1.2.7 identify computer and related technology resources for facilitating lifelong learning and emerging roles of the learner and the educator.

1.2.8 observe demonstrations or uses of broadcast instruction, audio/video conferencing, and other distant learning applications.

1.3 Application of Technology in Instruction.

Candidates will apply computers and related technologies to support instruction in their grade level and subject areas. They must plan and deliver instructional units that integrate a variety of software, applications, and learning tools. Lessons developed must reflect effective grouping and assessment strategies for diverse populations.

1.3.1 explore, evaluate, and use computer/technology resources including applications, tools, educational software and associated documentation.
1.3.2 describe current instructional principles, research, and appropriate assessment practices as related to the use of computers and technology resources in the curriculum.

1.3.3 design, deliver, and assess student learning activities that integrate computers and other technology for a variety of student grouping strategies and for diverse student populations.

1.3.4 design student learning activities that foster equitable, ethical, and legal use of technology by students.

1.3.5 practice responsible, ethical and legal use of technology, information, and software resources.

2.0 Specialty Content Preparation in Educational Computing and Technology Literacy.

Professional studies in educational computing and technology provide concepts and skills that prepare teachers to teach computer/technology applications and use technology to support other content areas.

2.1 Social, Ethical, and Human Issues.

Candidates will apply concepts and skills in making decisions concerning social, ethical, and human issues related to computing and technology.

2.1.1 describe the historical development and important trends affecting the evolution of technology and its probable future roles in society.

2.1.2 describe strategies for facilitating consideration of ethical, legal, and human issues involving school purchasing and policy decisions.

2.2 Productivity Tools.

Candidates integrate advanced features of technology-based productivity tools to support instruction.

2.2.1 use advanced features of word processing, desktop publishing, graphics programs and utilities to develop professional products.

2.2.2 use spreadsheets for analyzing, organizing
and displaying numeric data graphically.

2.2.3 design and manipulate databases and generate customized reports.

2.2.4 use teacher utility and classroom management tools to design solutions for a specific purpose.

2.2.5 identify, select, and integrate video and digital images in varying formats for use in presentations, publications and/or other products.

2.2.6 apply specific-purpose electronic devices (such as, a graphing calculator, language translator, scientific probeware, or electronic thesaurus) in appropriate content areas.

2.2.7 use features of applications that integrate word processing, database, spreadsheet, communication, and other tools.

2.3 Telecommunications and Information Access.

Candidates will use telecommunications and information access resources to support instruction.

2.3.1 access and use telecommunications tools and resources for information sharing, remote information access and retrieval, and multimedia/hypermedia publishing.

2.3.2 use electronic mail and Web browser applications for communications and for research to support instruction.

2.3.3 use automated online search tools and intelligent agents to identify and index desired information resources.

2.4 Research, Problem Solving, and Product Development.

Candidates will use computers and other technologies in research, problem solving, and product development. Candidates use a variety of media, presentation, and authoring packages; plan and participate in team and collaborative projects that require critical analysis and evaluation; and present products developed.

2.4.1 identify basic principles of instructional design associated with the development of multimedia and hypermedia learning materials.
2.4.2 develop simple hypermedia and multimedia products that apply basic instructional design principles.
2.4.3 select appropriate tools for communicating concepts, conducting research, and solving problems for an intended audience and purpose.
2.4.4 participate in collaborative projects and team activities.
2.4.5 identify examples of emerging programming, authoring, or problem solving environments.
2.4.6 collaborate in online workgroups to build bodies of knowledge around specific topics.
2.4.7 use a computer projection device to support and deliver oral presentations.
2.4.8 design and publish simple online documents that present information and include links to critical resources.
2.4.9 develop instructional units that involve compiling, organizing, analyzing, and synthesizing of information and use technology to support these processes.
2.4.10 conduct research and evaluate online sources of information that support and enhance the curriculum.

3.0 Professional Preparation.

Professional preparation in educational computing and technology literacy prepares candidates to integrate teaching methodologies with knowledge about use of technology to support teaching and learning.

3.1 Teaching Methodology.

Candidates will effectively plan, deliver, and assess concepts and skills relevant to educational computing and technology literacy across the curriculum.

3.1.1 design and practice methods and strategies for teaching concepts and skills related to computers and related technologies including keyboarding.
3.1.2 design and practice methods and strategies for teaching concepts and skills for applying productivity tools.
3.1.3 design and practice methods/strategies for teaching concepts and skills for applying
information access and delivery tools.

3.1.4 Design and practice methods and strategies for teaching problem-solving principles and skills using technology resources.

3.1.5 Observe in a K-12 setting where K-12 computer technology concepts and skills are being taught.

3.1.6 Practice methods and strategies for teaching technology concepts and skills in a lab and classroom setting.

3.1.7 Identify and support implementation and revision of computer or other technology literacy curriculum to reflect ongoing changes in technology.

3.1.8 Design and implement integrated technology classroom activities that involve teaming or small group collaboration.

3.1.9 Identify activities and resources to support regular professional growth related to technology.

3.1.10 Describe student guidance resources, career awareness resources, and student support activities related to computing and technology.

3.1.11 Compare national K-12 computer or other technology standards with benchmarks set by local school districts and critique each.

3.1.12 Identify professional organizations and groups that support the field of educational computing and technology.

3.1.13 Design a set of evaluation strategies and methods that will assess the effectiveness of instructional units that integrate computers/technology.

3.2 Hardware and Software Selection, Installation, and Maintenance.

Candidates will demonstrate knowledge of selection, installation, management, and maintainance of the infrastructure in a classroom setting.

3.2.1 Develop plans to configure computer or other technology systems and related peripherals in laboratory, classroom cluster, and other appropriate instructional arrangements.

3.2.2 Identify and describe strategies to support development of school and laboratory policies, procedures, and practices related to use of computers or other technology.
3.2.3 research, evaluate, and develop recommendations for purchasing instructional software to support and enhance the school curriculum.
3.2.4 research, evaluate, and develop recommendations for purchasing technology systems.
3.2.5 design and recommend procedures for the organization, management, and security of hardware and software.
3.2.6 identify strategies for troubleshooting and maintaining various hardware and software configurations.
3.2.7 identify and describe network software packages used to operate a computer network system.
3.2.8 configure a computer system and one or more software packages.
APPENDIX Q

DESCRIPTORS OF A CONSTRUCTIVIST APPROACH
### Descriptors of a Constructivist Approach

<table>
<thead>
<tr>
<th>Descriptor</th>
<th>Literature Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. Include opportunities for learners to carry on conversations about beliefs and assumptions that guide instruction</td>
<td>Dewey, 1944; Vygotsky, 1962; Castle &amp; Aichele, 1994; Sparks, 1994; Guskey &amp; Huberman, 1995</td>
</tr>
<tr>
<td>6. Provide reflective opportunities such as journals, action research, and conversations with peers about change</td>
<td>Vygotsky, 1962; Loucks, Newlove, &amp; Hall, 1987; Castle &amp; Aichele, 1994; Sparks, 1994; Darling-Hammond &amp; McLaughlin, 1995; Guskey &amp; Huberman, 1995</td>
</tr>
<tr>
<td>8. Provide a variety of experiences on different levels to allow for individual differences in experience and content knowledge</td>
<td>Ertmer &amp; Newby, 1993; NSDC, 1996; Carlin, Ciaccio, Sanders, &amp; Kress, 1997</td>
</tr>
<tr>
<td>9. Provide for sustained, ongoing, intensive learning opportunities supported by modeling, coaching, and collaborative problem solving</td>
<td>Dwyer, Ringstaff, &amp; Sandholtz, 1991; Darling-Hammond &amp; McLaughlin, 1995; Bradshaw, 1997b; Mergendoller, 1997; Marsh, 1999</td>
</tr>
</tbody>
</table>

Adapted from Beller’s Descriptors of a Constructivist Approach to Professional Development (1998)
APPENDIX R

SOFTWARE EVALUATION
<table>
<thead>
<tr>
<th>Game Title</th>
<th>Publisher</th>
<th>Copyright Date</th>
<th>Platform</th>
<th>Grade Level</th>
<th>Age range</th>
<th>Teaches</th>
<th>Suggested Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accelerated Reader</td>
<td>Advantage Learning Systems, Inc.</td>
<td>1999</td>
<td>Apple II, Mac, DOS, Win 93, Win 98 (disks or network)</td>
<td>1, 2, 3, 4, 5, 6, 7, 8, 9, S, J, Sr.</td>
<td>6-up</td>
<td>reading comprehension</td>
<td>$399.00+</td>
</tr>
<tr>
<td>Arthur's 1st Grade</td>
<td>The Learning Company</td>
<td>1999</td>
<td>Win 95, 98; Mac OS (CD-ROM)</td>
<td>1</td>
<td></td>
<td>reading, math, grammar, critical thinking</td>
<td>$29.95</td>
</tr>
<tr>
<td>The Clue Finders' 3rd Grade Adventures</td>
<td>The Learning Company</td>
<td>1997</td>
<td>Win 95, Win 3.1, Mac OS (CD-ROM)</td>
<td>2, 3</td>
<td>7-9</td>
<td>math, logic, problem solving, maps, reading comprehension</td>
<td>$29.99</td>
</tr>
<tr>
<td>The Clue Finders' 4th Grade Adventures</td>
<td>The Learning Company</td>
<td>1998</td>
<td>Win 95, Win 3.1, Mac OS (CD-ROM)</td>
<td>4, 5</td>
<td>8-10</td>
<td>math, reading, science, geography</td>
<td>$29.99</td>
</tr>
<tr>
<td>Disney/Pixar's Toy Story 2</td>
<td>Disney Interactive</td>
<td>1999</td>
<td>Game Boy Color</td>
<td>P, K, 1, 2, 3, 4, 5, 6, 7, 8, 9, S, J, Sr.</td>
<td>5-up</td>
<td>game play, logic</td>
<td>$29.99</td>
</tr>
<tr>
<td>Game</td>
<td>Publisher</td>
<td>Copyright Date</td>
<td>Platform</td>
<td>Grade Level</td>
<td>Age range</td>
<td>Teaches</td>
<td>Suggested Price</td>
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<tr>
<td>Let's Start Learning</td>
<td>The Learning Company</td>
<td>1995</td>
<td>Win 95, Win 3.1, Mac OS (CD-ROM)</td>
<td>P, K</td>
<td>2-5</td>
<td>letters, shapes, colors, patterns, numbers</td>
<td>$29.95</td>
</tr>
<tr>
<td>The Magic School Bus Explores Bugs</td>
<td>Microsoft Corp.</td>
<td>2000</td>
<td>Win 95, Win 98, Win NT (CD-ROM)</td>
<td>1, 2, 3, 4</td>
<td>6-10</td>
<td>science, geography, insects</td>
<td>$19.95</td>
</tr>
<tr>
<td>Read, Write, &amp; Type!</td>
<td>The Learning Company</td>
<td>1995</td>
<td>Win 95, Win 3.1, Mac OS (CD-ROM)</td>
<td>1, 2, 3</td>
<td>6-8</td>
<td>letter sounds, letter combinations, typing, phonics</td>
<td>$24.95</td>
</tr>
<tr>
<td>Reader Rabbit's Kindergarten</td>
<td>The Learning Company</td>
<td>1997</td>
<td>Win 95, Win 3.1, Mac OS (CD-ROM)</td>
<td>P, K, 1</td>
<td>4-6</td>
<td>logic, numbers, letters, sequencing, comparison, shapes</td>
<td>$29.95</td>
</tr>
<tr>
<td>Reader Rabbit's Math Ages 4-6</td>
<td>The Learning Company</td>
<td>1998</td>
<td>Win 95, 98; Mac OS (CD-ROM)</td>
<td>P, K, 1</td>
<td>4-6</td>
<td>math facts, counting, number sequencing</td>
<td>$29.95</td>
</tr>
<tr>
<td>Software</td>
<td>Publisher</td>
<td>Copyright Date</td>
<td>Platform</td>
<td>Grade Level</td>
<td>Age range</td>
<td>Teaches</td>
<td>Suggested Price</td>
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<tr>
<td>Reader Rabbit’s Reader 1</td>
<td>The Learning Company</td>
<td>1997</td>
<td>Win 95, Win 3.1, Mac OS (CD-ROM)</td>
<td>P, K, 1</td>
<td>4-7</td>
<td>letter-sound recognition, sounding out words, memory skills</td>
<td></td>
</tr>
<tr>
<td>Stickybear’s Kindergarten Activities</td>
<td>Optimum Resource, Inc.</td>
<td>1996</td>
<td>Win 95, Win 3.1, Mac OS (CD-ROM)</td>
<td>P, K</td>
<td>1-5</td>
<td>language, first aid, shapes, colors, numerals</td>
<td>$59.95</td>
</tr>
<tr>
<td>Storybook Weaver Deluxe</td>
<td>MECC (The Learning Company)</td>
<td>1996</td>
<td>Win 95, Win 3.1, Mac OS (CD-ROM)</td>
<td>1, 2, 3, 4, 5, 6</td>
<td>6-12</td>
<td>writing, illustrating stories and storybooks</td>
<td>$49.95</td>
</tr>
</tbody>
</table>
REFERENCES


Hall, G. E., George, A. A., & Rutherford, W.L. (1979). *Measuring stages of concern about the innovation.* Austin, TX: The University of Texas Research and Development Center for Teacher Education.


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


