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Predictors of teacher use of technology

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PREDICTORS OF TEACHER USE OF TECHNOLOGY

by

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DEDICATION

In memory of four great teachers:

My parents,

Galen Paul Northcutt

Catherine Roth Northcutt

And my two Jimmys

James Paul Northcutt

James Elmer Jennings

And in honor of

All teachers

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Problem Overview

Near the turn of the last century, John Dewey (1916) was concerned about decontextualized instruction in schools and the lack of transfer of learning to nonschool settings. Students were unable to connect what was learned in the classroom with real world applications. His solution was to find ways to help children work in educational settings with tools of the trades (e.g., a printing press, a weaving loom, construction tools or farming equipment) in ways that modeled the activity of adults. Today, current technology gives new life and new applications for Dewey's vision. In spite of this new vision for technological applications, it appears that teachers in a K-12 environment are not fully utilizing and implementing computers in classroom instruction and classroom management practices.

Educational technology can create environments in which students are able to participate more fully in meaningful, realistic activities. For example, a learning environment may be organized to promote peer interaction, enabling students to work cooperatively, with their teachers as collaborators. Computers in classrooms extend traditional instructional activities of teachers. Computers may be used to provide immediate feedback in drill and practice activities. Computers may be used for routine classroom management activities which would allow a teacher time for reflective practices as they design instruction and develop alternative methods of assessment.

Yet even when technological advancements are funded in schools, the equipment is often not fully utilized (Marcinkiewicz, 1994). These reasons may be varied. In one school district, teachers were not involved in the initial decision making and as a result,

they have not implemented the technology for its intended purpose. In another school district, computers were placed in the classrooms, but teachers were not provided with appropriate training, resulting in nonuse.

The adoption of technological processes, in many cases, necessitates the transformation of teachers' entire mindset and day. It may be necessary to modify lesson plans to integrate the computer into existing lessons or it may require entire new lessons. In order to accommodate new technology, the teachers must spend time learning hardware mechanisms and efficient use of software, as well as motivating their students to accept the computer as a learning tool and not as a toy.

This restructuring demands innovativeness by the instructional staff at a school. Innovativeness is defined by Hurt, Joseph and Cook (1977) as one's willingness to change. Given the innovative nature of technology, it may be increasingly necessary to help teachers adopt innovation as a way to keep current, access information, and develop a mindset which enhances a commitment to life-long learning.

However, the classroom is changing in ways beyond technology. There is a new movement in the philosophy of education. It is described as constructivism and its major tenet is that from birth through childhood and beyond, all success in learning is based on the meaning which individuals construct for themselves (Gruender, 1996). Consequently, a constructivist classroom is learner-centered; the teacher's role is to facilitate and devise situations in which students will be challenged to create ideas to solve the problems presented to them.

This type of learner centered environment can be contrasted to the typical classroom in which the predominant teaching model is direct instruction. In direct instruction, the student's role is primarily that of receiver and processor of information.

(Gruender, 1996). Goals and objectives are usually set by the curriculum developers and the instructional strategies are selected by the teacher; the substance and strategy of instruction are imposed on students, with little or no input from them.

In a constructivist classroom, students organize information, explore the learning environment, conduct learning activities, and monitor their own learning. The teacher assumes the role of reflective practitioner as students construct meaning for themselves and engage in critical thinking and problem solving. For some teachers, this environment may imply a loss of classroom control.

The education profession itself nourishes a cautious attitude toward change and teachers tend to view the classroom in nontechnical terms (Cuban, 1986). There are additional barriers to the adoption of technology. The introduction of innovative techniques and practices requires confidence on the part of the practitioner. Veteran and novice teachers alike must be able to make the connection between the utilization of technology and student benefits. Any change in instructional practice involves uncertainty. Teacher certainty and commitment feed off each other. As teachers become convinced of the student benefits which may result from the adoption of new instructional practices, they may become more motivated to adopt these practices (Cuban, 1986).

Because the traditional classroom is often teacher centered, the use of technology may require a shift in paradigm for instructional staff. As teaching and learning become more constructivist in nature, a learner centered environment is created in the classroom, requiring a loss of the control on the part of the teacher. Such loss may create anxiety which, coupled with computer anxiety, may inhibit the practitioner from adopting these changes.

There is a need to examine the attitudes of teachers toward technology and how

those attitudes affect the integration of technology into lesson planning, classroom management, and the delivery of instruction. These attitudes may be related to personal characteristics of teachers, as well as their level of self-efficacy and their extent of willingness to adopt innovation. In addition, variations in teachers' innovativeness may correspond to the grade level they teach. Elementary school teachers may be more open to trying new strategies in teaching because they work with the same student population throughout the school day. Middle school teachers often work with students in a team teaching environment and the student population requires innovativeness and willingness to adopt a variety of instructional strategies to maintain their interest in order to engage students in effective learning. High school teachers present a unique opportunity for study, since they generally teach in the same area through their entire work day which differs from elementary or middle school teachers who are responsible for teaching a broader array of subjects. High school teachers may be the most resistant to change, since they may feel they are providing their students with quality education without the use of a computer in lesson planning, classroom management, and the delivery of instruction.

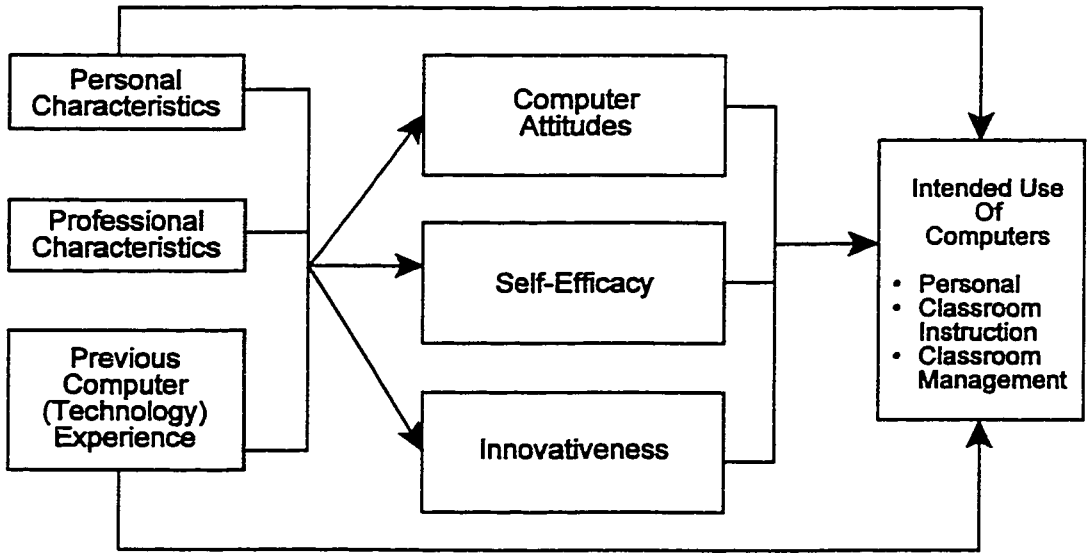
Conceptual Model

The conceptual model that organizes this study is based upon the literature. It explains teachers' intended use of computers. The domains examined in this study are computer anxiety, adult learning theory, self efficacy, and innovativeness. The model links the relevant variables in this study first by suggesting that profile characteristics and previous computer experience directly affect computer attitudes, as well participants' degree of self efficacy and extent of innovativeness. The model also proposes that relationships may also exist between profile characteristics, previous computer experience, and the intended use of computers on the part of the instructional staff. This

conceptual model is outlined in Figure 1 below.

Figure 1

Conceptual Model



An understanding of learners' characteristics is fundamental to instructional design models (Andrews & Goodson, 1980; Richey, 1986). For this study, demographic data consists of personal characteristics such as gender, age, marital status and number of children with professional characteristics including highest degree attained, building level, teaching experience, and curriculum area. In addition, a survey of previous computer experience and a self evaluation of computer skills will be assessed. Survey instruments include self rating surveys of computer attitudes, level of self efficacy, and degree of innovativeness.

Personal Characteristics

Gender differences have been found to be highly correlated with attitudes toward computer use, with males holding more positive attitudes toward computers and scoring higher in computer aptitude (Dambrot, et al., 1985). Research on computer use of males

and females suggests differences in perceptions and attitudes (Gilliland, 1990). Rogers (1983) found that females typically showed lower levels of acceptance of innovative behavior.

Little research exists regarding the relationship between the older (age fifty plus) learner and computer attitude and computer anxiety. One survey of this population (Morris, 1988) indicated that age and education had a direct effect on computer attitudes and that age was indirectly linked to attitudes through education. Another study of the potential of older adults for computer assisted instruction (Flynn, 1988) involved 701 adults aged 45 to 70 in three major metropolitan areas. The results suggest that the most committed users of CAI in the older population are likely to be women, minorities, and those with marked deficits in income and education. This might be explained by greater levels of motivation to achieve within this population. This population would seem to have a need for the options provided by proficiency in computer literacy. The results also indicated the possibility of teacher anxiety and bias as facilitators and providers of instruction to older adults.

There is a paucity of research relating martial status and number of children to computer use. It is hypothesized that there will be a relationship among these personal characteristics and computer attitudes, self efficacy, innovativeness, and the intended use of computers.

Professional Characteristics

A study by Rosen and Weil (1995) yielded results that indicate professional characteristics of the participants provide predictors of technophobia. Building level, teaching experience, and curriculum area accounted for varying levels of predicted computer anxiety. Their study involved elementary and secondary school teachers. The

current study included these, as well as middle school teachers.

Previous Computer Experience

Behavior is influenced by experience, and attitudes toward computers have been found to relate to computer experience (Dambrot, et al., 1985). In Sheingold and Hadley's survey (1990), computer experience was common to most of the respondents who had integrated computers into their teaching; 73% had used computers in their teaching for five years or more.

Computer Attitudes

Students instructed by teachers with positive attitudes toward technology have demonstrated improved performance (Moore, 1988). The Computer Attitude Survey (CAS) developed by Loyd and Gressard (1985) uses four subscales of computer attitude: anxiety, confidence, liking, and usefulness.

Level of Self-Efficacy

Bandura (1977) defined an efficacy expectation as "the conviction that one can successfully execute the behavior required to produce the outcomes" (p. 79). Research in self-efficacy indicated that one's strong belief in perceived self-efficacy played a critical role in determining performance (Bandura, 1986; Bandura & Schunk, 1981; Lock, Frederick, & Bobko, 1984). Growth in self-efficacy may motivate individuals to attempt and accomplish aspirations which they had previously considered insurmountable (George & Camarata, 1996). It has been hypothesized that teachers' level of self-efficacy should be a significant predictor of computer use.

Degree of Innovativeness

Rogers (1995) defines innovation as an idea, practice, or object that is perceived as new by an individual or other unit of adoption. He further differentiates this definition;

"newness of an innovation may be expressed in terms of knowledge, persuasion, or a decision to adopt" (p. 11), implying that the newness of an innovation need not require new knowledge. It is important in diffusion of innovation research to determine how the earlier adopters differ from the later adopters. Innovativeness has been found to be a personality characteristic and incorporates such variables as risk taking (Rogers & Shoemaker, 1971). The results of a study by Hurt, Joseph and Cook (1977) suggest that innovativeness contributes to the prediction of a teacher's level of computer use.

Purpose of the Study

As computers become an increasingly important component of the educational process, both in providing direct instruction and classroom management, it is essential to investigate teachers' willingness to adopt technology into their classrooms. The purpose of this study is to determine the predictors of the use of technology by instructional staff at the elementary, middle, and high school level in a semi-rural school district. Specifically, the following questions will be addressed:

1. What is the relationship between personal characteristics of teachers and their attitudes toward computers?

2. What is the relationship between personal characteristics of teachers and their level of self-efficacy?

3. What is the relationship between personal characteristics of teachers and their extent of innovativeness?

4. What is the relationship between professional characteristics of teachers and their attitudes toward computers?

5. What is the relationship between professional characteristics of teachers and their level of self-efficacy?

6. What is the relationship between professional characteristics of teachers and their extent of innovativeness?

7. What is the relationship between teachers' previous computer experience

and their attitudes toward computers?

8. What is the relationship between teachers' previous computer experience and their level of self-efficacy?

9. What is the relationship between teachers' previous computer experience and their extent of innovativeness?

10. What is the relationship between teachers'computer attitudes and their intended use of computers?

11. What is the relationship between teachers' self-efficacy and their intended use of computers?

12. What is the relationship between teachers' extent of innovativeness and their intended use of computers?

13. What is the relationship between teachers' personal characteristics and their intended use of computers?

14. What is the relationship between teachers' professional characteristics and their intended use of computers?

15. What is the relationship between teachers' previous computer experiences and their intended use of computers?

16. What is the relationship between teachers' computer attitudes, level of self-efficacy, and innovativeness and their intended use of computers?

17. What is the relationship between the intended use of computers and teachers' personal characteristics, professional characteristics, previous computer experience, computer attitudes, self-efficacy, and innovativeness?

Limitations of the Study

This study is limited to one school district and may not be generalizable to all school districts.

Significance of the Study

Teachers, as reflective practitioners, gain self understanding and through this insight increase their ability to model appropriate behavior for their students. Teachers who demonstrate computer literacy and proficiency are able to technologically empower

the students who learn from them (Morano, 1984). The overall improvement in learning which results from the appropriate use of technology is the objective of the implementation of technology in the practice of classroom instruction and classroom management. To achieve these goals, teachers must actually use computers.

A study of the differentiation between building level and the intended use of computers may yield varying results. If computer attitudes, the level of self-efficacy, and the extent of innovativeness can be predicted by building level, the design of professional development activities can provide the experiences which will technologically empower teachers and reduce varying degrees of technophobia and computer anxiety.

Chapter II

Review of the Literature

Government and academia appear to share the view that computer technology has an extensive and beneficial effect on K-12 education (National Task Force on Education Technology, 1986; Shanker, 1990; Sheingold & Hadley, 1990; United States Office of Technology Assessment [OTA], 1988). In addition, there is an increase in the supply of computers available for education (OTA, 1988). In spite of these supportive measures, there is a discrepancy between the expected and actual level of computer use by teachers. For this study, the role of teachers as adult learners, as well as the impact of computer anxiety on the adoption of technological innovations, was investigated.

The basic components of adult learning are identified as follows: a) self direction/autonomy as a characteristic or goal of adult learning; b) the relationship of experiences, especially those of adult life, to learning; c) the importance of reflection upon one's own learning, and d) action as some sort of necessary expression of the learning that has occurred (Merriam, 1987). Each of these components is seen to have specific applications in the use of technology.

High levels of computer anxiety lead to avoidance and thus prevent some people from using and learning about computers. The ability to overcome anxiety related to the use of technology can empower the adult learner and provide for more options in both the workplace and the academic setting. Providing individuals with appropriate training, course work, hands on and successful experiences with computers under nonthreatening conditions may reduce their overall computer anxiety.

The unique characteristics of the adult learner may enable teachers to master anxiety management abilities and cognitive coping skills, as well as relaxation techniques

and by so doing minimize or eliminate the debilitating effects of computer anxiety.

The literature review related to this study includes various components which may effect the intended use of computers by instructional staff. An investigation of the theoretical foundations of learner characteristics, as well as the specific characteristics of adult learners, was conducted. The literature review included the study of anxiety in general and the specific attribute of computer anxiety. Social learning theory, theories of innovation and diffusion of innovations were researched and the practices of exemplary teachers were examined. These practices include constructivist teaching and learning, and the development and organization of learner centered instruction in a K-12 environment. Change theory and characteristics of teachers as change agents were examined. Collectively, these elements are seen to contribute to the prediction of the intended use of computers by instructional staff.

Learner Characteristics

The best known "theory" of adult learning is andragogy, defined by Knowles (1984) as "the art and science of helping adults learn" (p. 43). Four assumptions are characteristics of adult learners:

1. As a person matures his or her self concept moves from one of a dependent personality toward one of a self directing human being.

2. An adult accumulates a growing reservoir of experience, a rich resource for learning.

3. The readiness of an adult to learn is closely related to the developmental tasks of his or her social role; and

4. There is a change in time perspective as individuals mature, from one of future application of knowledge to immediacy of application; thus an adult is more problem centered than subject centered in learning. (pp 45-45).

Knowles further explains andragogy as: a) a set of assumptions about adults as learners; and b) a series of recommendations for the planning, management, and

evaluation of adult learning. These presuppose two andragogical considerations: a) adults want to be self directed in their learning; and b) adults should be taught through collaborative methods.

A second attempt at theory building that rests upon characteristics of adults is Cross's Characteristics of Adults As Learners (CAL) model. Cross (1981) offered it as "a tentative framework to accommodate current knowledge about what we know about adults as learners" (p. 234). It is based on differences between children and adults and consists of two classes of variables, personal characteristics and situational characteristics. Personal characteristics include physical, psychological, and sociocultural dimensions. These reflect growth and development from childhood into adult life and are continuous. Situational characteristics focus on variables unique to adult participants — for example, part time versus full time learning, and voluntary versus compulsory participation. Cross's model offers a "framework for thinking about what and how adults learn" (page 238), in contrast to Knowles' theory which provides implications for practice. Both theories emanate from the characteristics of adult learners.

Life Situations of Adults

McClusky's Theory of Margin and Knox's Proficiency Theory are anchored in an adult's life situation with its attendant roles and responsibilities. Both are built on the notion of a need or "gap" — between current and desired proficiencies (Knox, 1980), or between power and load (McClusky, 1970). The latter refers to the balance as conceptualized as a ratio between the "load" of life, which dissipates energy, and the "power" of life, which allows one to deal with the load. The energy left over when one subtracts load from power, McClusky called "margin in life." McClusky felt that older persons could enhance their self esteem through learning and education relevant to their

life situation. "The preeminent need of the aging," he wrote, "is the need for that kind of education that will assist them in creating margins of power for the attainment and maintenance of well being and continuing growth toward self fulfillment" (1971, p. 2).

Knox's (1980) Proficiency Theory also speaks to an adult's life situation. Proficiency, as defined by Knox, is "the capability to perform satisfactorily if given the opportunity" and this performance involves some combination of attitude, knowledge, and skill (1980, p. 378). His theory is based on assumptions that adult learning is both developmental and transactional. The model that represents the theory contains the following interactive components: General Environment, Past and Current Characteristics, Performance, Aspiration, Self, Discrepancies, Specific Environments, Learning Activity, and Teacher Role.

Changes in Adult Consciousness

Reflection upon the content of one's environment and experiences is a common component in Freire's (1976) Theory of Conscientization. The process of perspective transformation begins with a disorienting dilemma to which one's old patterns of response are ineffective. Perspective transformation results in a new agenda for action. Action out of one's new perspective is an integral part of the theory.

According to Freire, education either oppresses or liberates. Conscientization, "the process in which men, not as recipients, but as knowing subjects, achieve a deepening awareness both of the sociocultural reality which shapes their lives and of their capacity to transform that reality" is what takes place in an authentic education encounter (1970, p. 27). Critical consciousness is marked by an in depth analysis of problems, self awareness, and self reflection.

Brookfield's (1986) characterization of adult learning as "transactional encounter"

seems to share the orientation of the theories based on changes in consciousness. "The particular function of the facilitator," he writes, "is to challenge learners with alternative ways of interpreting their experience and to present to them ideas and behaviors that cause them to examine critically their values, ways of acting, and the assumptions by which they live" (p. 23).

The basic components of adult learning are identified as follows: a) self direction/autonomy as a characteristic or goal of adult learning; b) the relationship of experiences, especially those of adult life, to learning; c) the importance of reflection upon one's own learning, and d) action as some sort of necessary expression of the learning that has occurred (Merriam, 1987). Each of these components is seen to have specific applications in the use of technology. High levels of computer anxiety lead to avoidance and thus prevent some people from using and learning about computers. The ability to overcome anxiety related to the use of technology can empower the adult learner and provide for more options in both workplace and academic settings. Providing individuals with appropriate training, course work, hands on and successful experiences with computers under nonthreatening conditions can reduce their overall computer anxiety. Unique characteristics of the adult learner may enable trainees to master anxiety management abilities and cognitive coping skills, as well as relaxation techniques and by so doing minimize or eliminate debilitating effects of computer anxiety.

Anxiety

Beck (1976) has argued that particular kinds of perceptions lead to specific corresponding feelings. Specifically, he has hypothesized that thoughts of being transgressed against lead to anger, thoughts of threat lead to anxiety, and thoughts of loss lead to sadness. This model has been tested in several case studies (Beck, 1963, 1970,

1972), and a structured interview was developed for use with clients (Beck, Laude, & Bohnert, 1974).

Sewitch and Kirsch (1984) tested the hypothesis that thoughts of threat or peril precede the experience of anxiety. The results showed that threat was the predominant type of thought reported to precede experienced anxiety. However, the design of the study did not permit an assessment of whether the predominance of thoughts of threat might also be found in other distressing states, such as sadness and anger.

Wickless and Kirsch (1988) investigated the degree to which thoughts of transgression, threat, and loss were associated, respectively, with subjective experiences of anger, anxiety, and sadness. They hypothesized that self-reported experiences of anger would be associated with thoughts of being wronged, anxiety with thoughts of threat or danger, and sadness with thoughts of loss. Their analyses of subjects' assessments of their own thoughts and feelings indicated that each type of thought (transgression, threat, and loss) tended to occur in combination with the others and that anger was associated with simultaneous reports of anxiety and sadness. Multiple regression analyses revealed that although anger was associated with thoughts of loss as well as thoughts of transgression, and sadness was associated with thoughts of threat as well as thoughts of loss, anxiety was uniquely predicted only by thoughts of threat.

Computer Anxiety

The recent growth of computer technology has been accompanied by an increasing number of individuals who are anxious about, or intimidated by, computers (Glass, Knight, & Baggett, 1985). Computer anxiety has been defined and assessed in a variety of ways. Powers (1973) defined computer anxiety as changed in physiological measures, such as blood pressure and heart rate, which occurred while subjects worked on

a computer. Attitudes toward computers have been a more frequent focus (Ahl, 1976; Coovert & Goldstein, 1980; Raub, 1982; Reece & Gable, 1982). Affective factors, such as fear, apprehension, and subjective anxiety, have also been identified (Loyd & Gressard, 1984). During actual computer interactions, greater computer anxiety was associated with lower expectations and poorer task performance, as well as with greater state anxiety, reported physiological arousal, and debilitative thoughts. Glass & Knight (1988) tested a cognitive model of computer anxiety, where computer anxiety was seen as a function of internal dialogue, underlying meaning system, behavioral acts and behavioral outcomes when working on a computer. The subjects were 59 undergraduate students who were selected from a group of 135 on the basis of their scores on the Computer Anxiety Rating Scale (CARS). Analyses revealed no sex differences in computer anxiety, in contrast to the significant relationship between gender and computer anxiety obtained by Jordan and Stroup (1982). However, the findings were consistent with the work of Gressard and Loyd (1984), who also failed to show higher levels of computer anxiety in women. In addition, high computer anxious individuals reported less computer experience and mechanical interest, and higher levels of math anxiety.

Research in the computer anxiety area has led to the development of at least four different measurement instruments: a) the Attitudes Toward Computers (ATC) scale (Raub, 1982), b) the Computer Anxiety Index (CAIN) developed by Maurer (1983), c) The Computer Attitude Scale (CAS) (Loyd and Gressard, 1984), and d) the Bloomberg-Erickson-Lowery-Computer Attitude Task (BELCAT-36) (Erickson, 1987). The Computer Experience Questionnaire (CEQ) was developed for use in the study by Heinssen, et al. (1987). It consists of a 27 item checklist which serves to examine the relationship between computer anxiety and the amount of experience subjects may have

had with computers. The results indicate moderate correlations between computer anxiety and both computer experience and mechanical interest. The 40 item short form of the Math Anxiety Rating Scale (Richardson & Woolfolk, 1980) was used in the assessment of computer anxiety conducted by Heinssen, et al. (1987). The MARS has been found to correlate inversely with math achievement scores and shows a significant positive relationship with other self report measures of attitudes toward math (Brush, 1978). Significant correlations between the CARS and measures of math and trait anxiety (Heinssen, et al., 1987) replicate the findings of Gressard and Loyd (1984), Maurer (1983) and Raub (1982). These correlations were of low to moderate magnitude which might suggest that the subjects perceive computers as math based tools.

Research on computer attitudes has also led to the development of several different measurement instruments. Two such instruments with known psychometric properties are the Attitudes Toward Computer Usage Scale (ATCUS) (Popovich, Hyde, Zakrajsek, & Blumer, 1987) and the Computer Attitudes Scale (CATT) (Dambrot, Watkins-Malek, Silling, Marshall, & Garver, 1985). ACTUS scores indicated that females held more negative computer attitudes than did males. Dambrot's 20 item CATT measure (1987) was shown to be weakly related to math anxiety and computer experience. Consistent with Popovich et al.'s findings (1987), results also indicated that females were more negative in their attitudes toward computers than were males.

Computer anxiety was found to significantly correlate with three other anxiety indices: a) state anxiety, b) trait, and c) math anxiety. (Kernan & Howard, 1990). However, none of the four computer attitude factors consistently correlated with these three anxiety variables. Their analyses suggest that interactions with the computer itself, especially over a 12-13 week period, may change one's view of computer and that

computer anxiety can be successfully distinguished from computer attitudes in a fairly reliable and valid manner.

Although the ages of the subjects were not differentiated according to adult (18 to 49 years) or older (age fifty and over) learner, the subjects in the studies cited are male and female undergraduate and graduate adult students. The experience of computer anxiety in the adult/older learner appears to relate to the distinctive features of the learner.

Theories of Innovation

Much of the research on innovation has been conducted in the field of communication theory (Bandura, 1977; Hurt, Joseph & Cook, 1977; Rogers, 1983, 1995). Rogers defines innovation as "an idea, practice, or object that is perceived as new by an individual or other unit of adoption" (p 11).

Other researchers have defined innovation as a degree of risk taking (Cancion in Hurt, Joseph, & Cook, 1977), or as part of an individuals' capacity to be receptive to change (Donnelly & Etzel; Popielarz; in Hurt, et al.). Fliegal and Kivlin defined innovation as including a high reward value, involving risk, and involving uncertainty (in Hurt, et al.).

Innovation may also be viewed as a behavior rather than an idea, program, service, or process. This concept of innovation focuses on the individual, suggesting that innovation is a personality characteristic (Rogers & Shoemaker in Hurt, et al., 1977). The definition of innovation as an "underlying personality construct, which may be interpreted as a willingness to change", provided a simple and consistent estimate for measuring levels of innovation, enabling researchers using this variable to achieve reliable predictability (Hurt, et al., p. 1). This definition of innovativeness was selected by the researcher to use for the survey instrument which measured levels of innovativeness.

Rogers (1995) developed five characteristics which predicted the rate of individual or group adoption to an innovation:

1. Relative Advantage - The degree to which an innovation is perceived as superior to the idea it replaces. An innovation will be adopted more rapidly if it is perceived to have a high degree of relative advantage.
2. Compatibility - The degree to which the innovation is perceived as consistent with existing values, past experiences, and needs of potential adopters. An incompatible innovation may require the prior adoption of a new value system which is a relatively slow process. The compatibility of an innovation, as perceived by members of a social system, is positively related to its rate of adoption.
3. Complexity - The degree to which an innovation is perceived as difficult to understand the use. New ideas that are simple to understand and use are adopted more rapidly than those that require the adopter to develop new skills and knowledge. The complexity of an innovation, as perceived by members of a social system, is negatively related to its rate of adoption.
4. Triability - The degree to which an innovation may be experimented with - on a limited basis. An innovation that is triable represents less uncertainty to the individual who is considering it for adoption, and it is possible to learn by doing. The triability of an innovation, as perceived by the members of a social system, is positively related to its rate of adoption.
5. Observability - The degree to which the results of an innovation are visible to others. Individuals are more likely to adopt an innovation if they can see the results. The observability of a social system, as perceived by the

members of a social system, is positively related to its rate of adoption.

Innovations which are perceived by individuals as having these five characteristics (relative advantage, compatibility, complexity, triability, and observability) will be adopted more readily than other innovations.

Diffusion of Innovations

Rogers (1995) defines diffusion as "the process by which an innovation is communicated through certain channels over time among the members of a social system" (p. 10) and further describes it as a very social process. Homophily is defined by Lazarfeld and Merton (1964) as the degree to which two or more individuals who interact are similar in certain attributes such as beliefs, education, and social status. Its converse, heterophily, is defined by Lazarfeld and Merton (1964) as the degree to which two or more individuals who interact are different in certain attributes. An additional extension of these concepts includes the idea of empathy, which is defined as the ability of an individual to project into the role of another. More effective communication occurs when two individuals are homophilus, unless they have high empathy (Rogers, 1995). Rogers states that effective communication between two individuals leads to greater homophily in knowledge, beliefs, and overt behavior. Bandura (1977) asserts that "successful diffusion of innovation follows a common pattern: new behavior is introduced by prominent examples, it is adopted at a rapidly accelerating rate, and it then either stabilizes or declines depending upon its functional value" (p. 50).

Cumulative Curve of Distribution

Innovators in a social system adopt in an over-time sequence which has been found to follow an S-shaped curve of cumulative adoption (Rogers, 1995). The S-shaped adopter distribution rises slowly at first, accelerates to a maximum until half of the

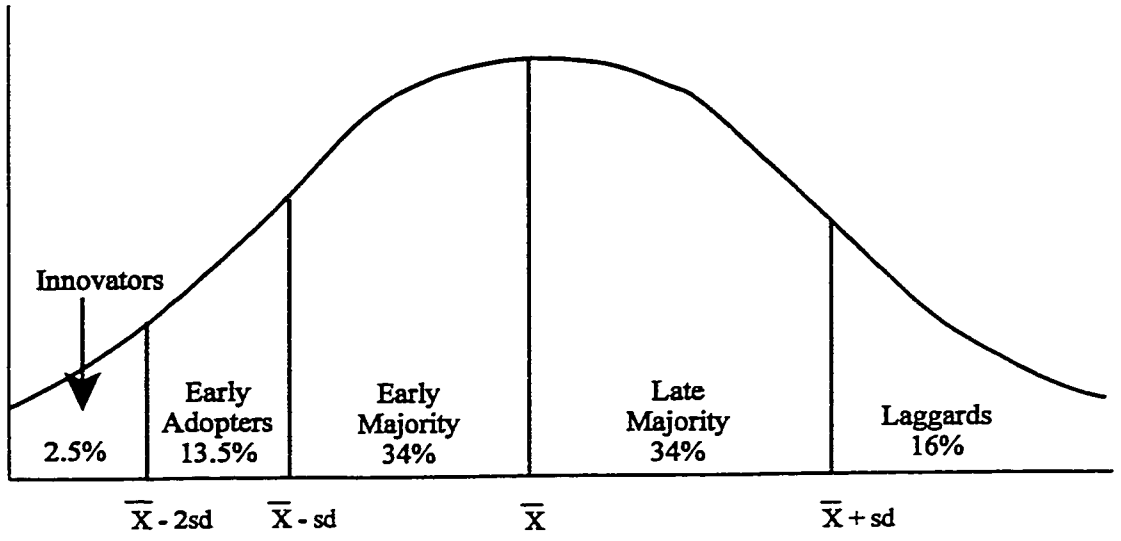
individuals in the system have adopted, increases at a gradually slower rate as fewer remaining individuals adopt the innovation. The S-shaped curve is innovation specific and system specific, and only describes cases of successful innovation in which the innovation spreads to most of the potential adopters in a social system.

Frequency Curve of Distribution

Innovation can be shown on a frequency curve that represents the classification from innovator to laggard. Figure 2 presents the graphical representation of the frequency curve.

Figure 2

Frequency Distribution of Innovation



Adopter classification has been found to be a normally distributed construct (Rogers, 1995), and to graph as a bell shaped, asymmetrical curve, with the mean and standard deviation used to divide the normal adopter distribution into categories. Innovators comprise 2.5% of the population and are described as venturesome. The innovator may not be respected by the others members of a social system, the innovator

plays a gatekeeping role in the flow of new ideas into a system (Rogers, 1995).

Early adopters comprise 13.5% of the population and are described as respected. Potential adopters look to early adopters for advice and information about the innovation. Early adopters serve as a role model for many others members of a social system (Rogers, 1995).

Early majorities comprise 34% of the population and are described as deliberate. These individuals adopt new ideas just before the average member of a system. Early majorities seldom hold positions of leadership in a system although they may interact frequently with their peers (Rogers, 1995).

Late majorities comprise 34% of a population and are described as skeptical. Late majorities do not adopt new ideas until most others in the system have done so (Rogers, 1995).

Laggards comprise 16% of the population and are described as traditional. Laggards possess very little opinion leadership and their point of reference is the past. Laggards interact primarily with others who have relatively conventional values.

Constructivism

Constructivism is a theory of knowledge derived from the philosophical proposition that reality is created or constructed by the individual (Yarusso, 1992). Constructivism is considerably more intricate than this simplistic definition and operates at a cognitive (individual) and a social (community) level.

Cognitive constructivism implies that individuals develop their own models of reality using both personal experience and research-based data. Social constructivism purports that individuals use their social connections in a community to develop, design, and formalize these constructs. By communicating with each other, learners test these

constructs (Whitman, 1993).

The premise of Objectivist theory, more traditional in Western culture than Constructivisit theory, is that knowledge exists in the world external to personal experience. Constructivist theory postulates that personal experience cannot be separated from knowledge. Since the learner may "construct" the world in a variety of ways, there may not be a single correct goal that we are pursuing as learners (Duffy & Jonassen, 1991). A problem solving approach to teaching and learning is consistent with constructivist theory as learners are regarded as independent users of tools. Rather than deciding what learners should know and providing instructional activities to present this knowledge, teachers should select problems relevant to the learners and provide tools to understand and solve these problems (Cunningham, 1991). When learners work together collaboratively, they may become dissatisfied with their existing knowledge when they compare their opinions with others (Solomon, 1989) and as learners work together to solve problems and articulate solutions, they adjust prior understandings to accommodate new information (Cennamo, Abell, Chung, 1996).

Learner Centered Instruction

As K-12 learning institutions engage in reform and restructuring (Banathy, 1991), and human resource development in business and industry stress the workplace as a learning organization (Senge, 1991), the emphasis in teaching and training is moving from an instructor centered and objectivist viewpoint to a learner centered and constructivist position. Emperical research in this field (McCombs, 1997) resulted in the delineation of Twelve Learner Centered Psychological Principles (APA, 1995).

The implementation of the twelve principles indicates a new perspective in instructional practices; a perspective that emphasizes learning, motivation, and

achievement (Wagner & McCombs, 1995). As learners construct meaning through prior knowledge and connections, there may be more than one valid approach and more than one "right" answer (Duffy & Jonassen, 1991).

This type of ambiguity might be unacceptable to teachers and trainers who are responsible for their students achievement of specific and mandated performance based outcomes. In response to these concerns, constructivists stress establishing cognitive experiences in authentic activities (Brown, Collins, & Duguid, 1989). Learners are expected to use their prior knowledge, connect this to the new learning, and adjust their instruction to adapt to the realities of the given situation.

Four factors in the teaching environment were found to contribute to the presence of exemplary computer users among third through twelfth grade teachers of academic subjects (Becker, 1994). Those factors were identified as:

1) Collegiality among users
2) School support for using computers for meaningful activities
3) Resources allocated for staff development and computer coordination
4) Smaller class sizes

Social Learning Theory

Social learning and diffusion have much in common. Both theories seek to explain how learning takes place through the communication of ideas and behaviors. Social learning theory states that an individual learns from another by means of observational modeling (Bandura, 1964) and that the learner imitates the behavior by following a similar (but not necessarily the same) behavior.

Bandura (1977) identifies the four processes of observational learning:

Attentional Processes - These processes determine what is selectively observed

and selectively extracted from these observations. The people who are consistently observed by the learner, either through preference or mandate, determine the types of behavior that will be most often observed and learned most thoroughly.

Retention Processes - Two representational systems (imaginal and verbal) are cited in order for long term learning to take place. Bandura (1977) asserts that visual imagery is critical when verbal skills are lacking and when learning behavior patterns do not lend themselves readily to verbal coding. Verbal coding accounts for most of the cognitive processes that regulate behavior (Bandura, 1977).

Motor Reproduction Processes - This involves transforming the observed, attended, and retained modeling into applicable behavior (Bandura, 1977). This process requires self corrective adjustments by the learner, and informed feedback to the learner.

Motivation Processes - Learners are more likely to adopt modeled behavior if it results in consequences they value. Behaviors that are seen to effect positive results are favored over those which are perceived to result in unrewarding or negative outcomes (Hicks, 1971).

Self Efficacy

Bandura (1977) distinguishes between efficacy and outcome expectation. He defines an efficacy expectation as "the conviction that one can successfully execute the behavior required to produce the outcomes" (p. 79). He defines outcome expectancy as "a person's estimate that a given behavior will lead to certain outcomes" (p. 79).

Bandura (1986) defined perceived self efficacy as follows:

> . . . people's judgement of their capabilities to organize and execute courses of action required to attain designated types of performance. It is concerned not with the skills one has but with the judgements of what one can do with whatever skills one possesses (p. 391).

According to self-efficacy theory (Bandura, 1977), two types of expectancies

exert powerful influence on behavior:

1) Outcome expectancy – The belief that certain behaviors will lead to certain outcomes, and
2) Efficacy expectancy – The belief that one can successfully perform the behavior in question to produce the outcome.

Individuals with a strong sense of efficacy are more prone to associate failure on difficult tasks to inadequate effort and high self-efficacy motivates individuals to intensify their efforts and persevere in working toward desired goals (Bandura & Cervone, 1983). One of the earliest applications of self-efficacy theory was exploration of the relationship between self-efficacy expectations and specific phobias and phobic avoidance behavior (Maddus, 1991).

Change

Hall and Hord (1987) and Hord, Rutherford, Huling-Austin, and Hall (1987) have identified seven stages of concern that individuals go through as they adopt changes in classroom practices. This Concerns-Based Adoption Model (CBAM) addresses how innovations are perceived by individuals, and how they feel about it. The model represents a hierarchical system, in which an individual progresses from one stage to another. These stages and characteristics are:

Stage 0: Awareness concerns

Stage 1: Informational concerns

Stage 2: Personal concerns

Stage 3: Management concerns

Stage 4: Consequence concerns

Stage 5: Collaboration concerns

Stage 6: Refocusing concerns

The first stage, Stage 0, represents an individual who has little, if any, knowledge of the changes provided by the use of technology. The remaining stages reflect three categories of concerns. Stages 1 and 2 reflect self concerns; what is the change and what will be the effect of the change on the individual? Stage 3 represents task oriented concerns; how will the change be implemented and what are the particular requirements in order to initiate the change? Stage 4 through 6 characterize impact oriented concerns; how is the change effecting students and colleagues, how will one work with others who are also implementing these initiatives?

The progression through these seven Stages of Concern involves three levels: Initiation, implementation, and institutionalization (Gann, 1993). In the initiation phase, teachers are learning about the innovation. During the implementation phase, teachers are involved in trying to implement the instructional practice or program. The final phase, institutionalization, represents the period when the new practice or program becomes part of the school system.

Utilization and Implementation

Richey and Seels (1994) stated that utilization may have the most extensive history of any of the domains of Instructional Technology. Since the first decade of the 20th century, teachers have had to make decisions regarding the selection and implementation of technology. Richey and Seels (1994) define implementation as "using instructional materials or strategies in real (not simulated) settings" and institutionalization as "the continuing, routine use of the instructional innovation in the structure and culture of an organization" (p. 47). Implementation may be seen as an individual (teacher) choice, and instutionalization as a community (school wide or district

wide) selection.

The review of the literature led to the hypothesis that the predictors of teacher use of technology would be related to these areas of research: An individual's level of self-efficacy, degree of innovativeness, and attitudes toward computers. It was further hypothesized that demographic variables would be related to the predictors of teacher use of technology. The intended use of computers for personal use, classroom instruction, and classroom management is seen to be an implementation issue within the domain of utilization in Instructional Technology.

Chapter III

Methodology

Using a correlational survey research design, this study focused on the predictors of computer use by teachers in a semi rural school district. The topics addressed in this methodology section are: the population, a description of the survey instrument, data collection procedures, and data analysis.

Population

The population consisted of 146 teachers in a semi-rural school district with a middle class socio-economic level. The district covers one hundred and ten square miles, and operates within a sixteen million dollar budget. There are four elementary schools, one middle school and one high school. The district serves 2,708 students in a K-12 setting. There are three central office administrators: one superintendent, one director of business, and one curriculum director. Forty-seven of the 146 teachers (32.2%) teach in the four elementary schools.

Instruments

Three instruments previously published in the literature were combined to form a self reporting survey questionnaire for this study:

1. Computer Attitude Scale (CAS) developed by Loyd and Gressard (1985)
2. Self-Efficacy Scale (SES) developed by Sherer, et al. (1982)
3. Innovativeness Scale developed by Hurt, Joseph and Cook (1977)

Computer Attitude Scale (CAS) Section I of the survey instrument (Appendix A) used the Computer Attitude Scale (Loyd & Gressard, 1985) to assess teachers' attitudes toward integration of computer technology. Using four subscales of computer attitude, *anxiety, confidence, liking and usefulness*, the instrument consists of 40 items (10 items

for each subscale) positively and negatively worded form "strongly agree" to "strongly disagree" yielding statements of attitudes toward use of computers employing a five-point Likert scale. High scores on each subscale indicate more positive attitudes and all 40 items will be used. CAS subscale questions can be found in Appendix A..

Reliability and validity studies were completed on the CAS by Loyd and Loyd (1985) in which 114 teachers of children in grades K-12 were surveyed as they completed a course in staff development using a microcomputer. Ages of the subjects ranged from 23 to 60, of which 33 of the subjects were male and 81 were female. Reliability data for the CAS questionnaire appear in Table 1.

Table 1

Coefficient Alpha Reliabilities

SUBSCALE	ALPHA COEFFICIENT
Computer Anxiety	.90
Computer Confidence	.89
Computer Liking	.89
Computer Usefulness	.82
Total Score [Overall Attitude Estimate]	.95

CAS was alpha tested for internal-consistency using four computer attitude subscales of *anxiety, confidence, liking, and usefulness*. Acceptable reliability coefficients were established for each subscale.

CAS was also tested using four analysis of variance (ANOVA) procedures, one for each of four subscales which established acceptable F ratios for internal differential validity. Differential internal validity for the CAS questionnaire differentiated among teachers with different amounts of computer experience. Differential validity data for the

CAS questionnaire appeared in Table 2.

Table 2

Differential Validity

SUBSCALE	F Ratio	DF	alpha level
Computer Anxiety	3.91	2,109	p = .02
Computer Confidence	3.00	2,109	p = .05
Computer Liking	3.20	2,109	p = .05
Computer Usefulness	3.70	2,109	p = .03

Self-efficacy Scale. General and social expectations of self-efficacy are two subscales measured by the Self-efficacy Scale. The subscale, General Self-Efficacy, is the general feeling one has about his ability to perform a task, whereas social Self-Efficacy is the belief of a person's ability to interact with other people successfully. This instrument took approximately 15 minutes to complete and was self-administered. The assumptions underlying this scale are change and individual differences in past experiences and associations of success lead to distinct levels of generalized self-efficacy expectations (Sherer et al., 1982). Thirty items comprise the scale, with a Likert scale used for rating each statement. The scaling on these items involves a five point scale with a 1 indicating "disagree strongly" and a 5 indicating "agree strongly." In his explanation of the protocol for scoring the instrument, Sherer (1982), indicated that 13 items were negatively worded and responses from the participants had to be recoded before determining the degree of self-efficacy. Seven items were filler items and were excluded from the scoring. Filler items were included to draw the test-taker's attention away from the purpose of the test and thus reduce the possibility of responding without reading the items. These items were not scored or evaluated in arriving at the test-taker's final result. Higher scores on the

self-efficacy scale provide evidence of higher self-efficacy expectations. Table 3 presents the breakdown of items that comprise the general and social self-efficacy subscales, as well as the filler items.

Table 3

Breakdown of Items on the Self-Efficacy Scale

Subscale/Filler	Item Numbers	Total Number of Items in Each Subscale
General Self-Efficacy	2, 3*, 4, 7*, 8*, 11*, 12, 15, 16, 18*, 20*, 22*, 23, 26*, 27, 29*, 30*	17
Social Self-Efficacy	6*, 10, 14*, 19, 24*, 28	6
Filler Items	1, 5, 9, 13, 17, 21, 25	7

* Indicates Items that are Reverse Scored

The Self-Efficacy Scale is an instrument with established reliability and validity. The theoretical foundation for the instrument is based on extensive research, including the theory of self-efficacy developed by Bandura (1977). The instrument had been used in previous psychological testing and had been shown to be reliable and valid. The Self-Efficacy Instrument has internal consistency with alphas of .86 for the general subscale and .71 for the social subscale. No test-retest data has been reported to date. Criterion validity has been determined by accurately predicting that people with higher self-efficacy would have greater success than those who scored low in self-efficacy in past vocational, educational, and monetary goals (Maddux, Sherer, & Rogers, 1982; Sherer, et al, 1982). The Self-Efficacy Scale has also demonstrated construct validity by correlating significantly in predicted directions with a number of measures such as the Ego Strength Scale, Interpersonal Competency Scale, and Rosenberg Self-Esteem Scale.

Innovativeness Scale (IS). Section III of the survey instrument used the

Innovativeness Scale (Hurt, Joseph & Cook, 1977) to assess the degree of innovativeness of the subjects. The instrument consists of twenty items (positively and negatively worded from "strongly agree" to "strongly disagree") yielding statements of innovativeness employing a seven-point Likert scale. High scores indicate a high degree of innovativeness.

Demographics. Section IV of the survey instrument was designed by the writer to collect descriptive data of the subjects. This data reflected the following profile characteristics: personal characteristics such as age, gender, marital status and number of children and professional characteristics such as building level, academic area, number of years in education, number of years in current position, number of years using a computer, and a self rating of computer skills (from poor to excellent). All answers on these items used forced-choice categorical response formats or fill-in where appropriate.

Computer Use. Section V of the survey instrument was designed by the writer to assess the subjects' current and intended use of computers for personal applications, classroom instruction, and classroom management. The instrument consisted of nine items and employed a 4-point Likert scale.

Research Design

A correlational research design was used for this study. Using data collected from the survey, the relationships between the dependent and independent variables were explored. The antecedent variables considered were the profile characteristics of the subjects and the independent variable investigated in this study were the subjects' attitudes toward computers, self-efficacy level, and extent of innovativeness. The dependent variable examined were the subjects' intended use, both professional and personal, of computers. Multiple regression analysis and path analysis were the primary

data analysis tools for this study.

Data Collection Procedures

Following approval from the Behavior Investigation Committee (BIC) the survey packets were developed for distribution to the teachers included in the study. The survey packets included a copy of the cover letter, surveys, and a self-addressed stamped envelope for return of the completed instruments. In addition, a pocket pal calendar/planner were enclosed as a thank you for their participation.

The cover letter conformed to the requirements of the BIC and contained the title of the study, the purpose and importance of the study, instructions for completing the instrument, assurances of confidentiality, the voluntary nature of their participation, and instructions for returning the completed survey instrument.

Prior to the distribution of the survey, the surveys were coded to provide followup of nonresponders. The coding was be explained to the participants in the cover letter. The researcher established a log that included the name, address, and code number of the respondent and date the survey was sent. As surveys are returned, the researcher recorded the date returned. Two weeks after initial distribution, the researcher sent reminders to all nonresponders to encourage them to complete and return the survey. This reminder also provided a telephone number in the case a second survey packet was needed. Four weeks following initial distribution, all data collection was considered complete, and the log book was destroyed.

Data Analysis

Data collected from the surveys was entered in to a computer file for statistical analysis using the SPSS - Windows, version 7.5. The analysis included both descriptive and inferential statistical analyses. The demographic analysis used descriptive statistical

procedures, such as measures of central tendency and dispersion, crosstabulations and contingency tables, and frequency distributions, to provide a profile of the respondents. The hypotheses were tested using multiple linear regression analyses. The model developed for this study was tested using path analysis to determine which of the independent variables form causal relationships with the dependent variable. All decisions on the statistical significance of the findings were made using an alpha level of .05.

Figure 3

Statistical Analysis

Research Question	Variables	Statistical Analysis
1. What is the relationship between personal characteristics of teachers and their attitudes toward computers?	Dependent Variables Attitudes toward computers • Computer anxiety • Computer confidence • Computer liking • Computer usefulness Independent Variables • Age • Gender • Marital Status • Number of Children	Stepwise multiple linear regression analyses were used to determine which of the independent variables could be used to predict the dependent variables.
2. What is the relationship between personal characteristics of teachers and their level of self-efficacy?	Dependent Variables • General self-efficacy • Social self-efficacy Independent Variables • Age • Gender • Marital Status • Number of Children	Stepwise multiple linear regression analyses were used to determine which of the independent variables could be used to predict the dependent variables.
3. What is the relationship between personal characteristics of teachers and their extent of innovativeness?	Dependent Variables • Extent of innovativeness Independent Variables • Age • Gender • Marital Status • Number of Children	Stepwise multiple linear regression analysis was used to determine which of the independent variables could be used to predict the dependent variables.

Figure 3 (Continued)

Statistical Analysis

Research Question	Variables	Statistical Analysis
4. What is the relationship between professional characteristics of teachers and their attitudes toward computers?	Dependent Variables Altitudes Toward Computers • Computer anxiety • Computer confidence • Computer liking • Computer usefulness Independent Variables • Highest degree earned • Building level • Number of years in education • Number of years in current position	Stepwise multiple linear regression analyses were used to determine which of the independent variables could be used to predict the dependent variables.
5. What is the relationship between professional characteristics of teachers and their level of self-efficacy?	Dependent Variables • General self-efficacy • Social self-efficacy Independent Variables • Highest degree earned • Building level • Number of years in education • Number of years in current position	Stepwise multiple linear regression analyses were used to determine which of the independent variables could be used to predict the dependent variables.
6. What is the relationship between professional characteristics of teachers and their extent of innovativeness?	Dependent Variables • Extent of innovativeness Independent Variables • Highest degree earned • Building level • Number of years in education • Number of years in current position	Stepwise multiple linear regression analysis was used to determine which of the independent variables could be used to predict the dependent variables.
7. What is the relationship between teachers' previous computer experience and their attitudes toward computer?	Dependent Variables Attitudes Toward Computers • Computer anxiety • Computer confidence • Computer liking • Computer usefulness Independent Variables • Access to computers • Number of years using computers • Self-rating of computer skills	Stepwise multiple linear regression analysis were used to determine which of the independent variables could be used to predict the dependent variables.
8. What is the relationship between teachers' previous computer experience and their level of self-efficacy?	Dependent Variables • General self-efficacy • Social self-efficacy Independent Variables • Access to computers • Number of years using computers • Self-rating of computer skills	Stepwise multiple linear regression analyses were used to determine which of the independent variables could be used to predict the dependent variables.

Figure 3 (Continued)

Statistical Analysis

Research Question	Variables	Statistical Analysis
9. What is the relationship between teachers' previous computer experience and their extent of innovativeness?	Dependent Variables • Extent of innovation Independent Variables • Access to computers • Number of years using computers • Self-rating of computer skills	Stepwise multiple linear regression analysis was used to determine which of the independent variables could be used to predict the dependent variables.
10. What is the relationship between teachers' computer attitudes and their intended use of computers?	Dependent Variables Intended Use of Computers • Personal • Classroom instruction • Classroom management Independent Variables Attitudes toward computers • Computer anxiety • Computer confidence • Computer liking • Computer usefulness	Stepwise multiple linear regression analyses were used to determine which of the independent variables could be used to predict the dependent variables.
11. What is the relationship between teachers' self-efficacy and their intended use of computers?	Dependent Variables Intended Use of Computers • Personal • Classroom instruction • Classroom management Independent Variables • General self-efficacy • Social self-efficacy	Stepwise multiple linear regression analyses were used to determine which of the independent variables could be used to predict the dependent variables.
12. What is the relationship between teachers' extent of innovativeness and their intended use of computers?	Dependent Variables Intended Use of Computers • Personal • Classroom instruction • Classroom management Independent Variables • Extent of innovation	Stepwise multiple linear regression analyses were used to determine which of the independent variables could be used to predict the dependent variables.
13. What is the relationship between teachers' personal characteristics and their intended use of computers?	Dependent Variables Intended Use of Computers • Personal • Classroom instruction • Classroom management Independent Variables • Age • Gender • Marital Status • Number of Children	Stepwise multiple linear regression analyses were used to determine which of the independent variables could be used to predict the dependent variables.

Figure 3 (Continued)

Statistical Analysis

Research Question	Variables	Statistical Analysis
14. What is the relationship between teachers' professional characteristics and their intended use of computers?	Dependent Variables Intended Use of Computers • Personal • Classroom instruction • Classroom management Independent Variables • Highest degree earned • Building level • Number of years in education • Number of years in current position	Stepwise multiple linear regression analyses were used to determine which of the independent variables could be used to predict the dependent variables.
15. What is the relationship between teachers' previous computer experiences and their intended use of computers?	Dependent Variables Intended Use of Computers • Personal • Classroom instruction • Classroom management Independent Variables • Access to computers • Number of years using computers • Self-rating of computer skills	Stepwise multiple linear regression analyses were used to determine which of the independent variables could be used to predict the dependent variables.
16. What is the relationship between teachers' computer attitudes, level of self-efficacy, and innovativeness and their intended use of computers?	Dependent Variables Intended Use of Computers • Personal • Classroom instruction • Classroom management Independent Variables Attitudes toward computers • Computer anxiety • Computer confidence • Computer liking • Computer usefulness • General Self Efficacy • Social Self-Efficacy • Extent of innovativeness	Stepwise multiple linear regression analyses were used to determine which of the independent variables could be used to predict the dependent variables.

Figure 3 (Continued)

Statistical Analysis

Research Question	Variables	Statistical Analysis
17. What is the relationship between the intended use of computers and teachers' personal characteristics, professional characteristics, previous computer experience, computer attitudes, self efficacy, and innovativeness?	Dependent Variables Intended Use of Computers • Personal • Classroom instruction • Classroom management Independent Variables • Age • Gender • Marital Status • Number of Children • Highest degree earned • Building level • Number of years in education • Number of years in current position • Access to computers • Number of years using computers • Self-rating of computer skills Attitudes toward computers • Computer anxiety • Computer confidence • Computer liking • Computer usefulness Self-Efficacy • General Self-Efficacy • Social Self-Efficacy Extent of Innovativeness	Stepwise multiple linear regression analyses were used to determine which of the independent variables could be used to predict the dependent variables.

Chapter IV

Results of Data Analysis

This chapter presents the results of the data analysis that were used to describe the sample and answer the research questions posed for this study. The purpose of this study was to determine predictors of the use of technology by instructional staff at the elementary, middle, and high school level in a semi-rural school district.

One hundred forty-six surveys were distributed to teachers in this school district. Of this number, 108 were completed and returned for a response rate of 74.0%.

Frequency distributions were used to summarize the categorical items and measures of central tendency and dispersion and thereby describe the continuous variables in the first section. The second section this chapter shows the results of the stepwise linear regression analyses used to answer each of the research questions.

Description of the Sample

Personal Characteristics

Data were collected on a variety of profile characteristics, including gender, age, marital status, and number of children. The respondents were asked to indicate their gender. These data are presented in Table 4.

Table 4

Personal Characteristics of the Teachers by Building Level (N=108)

Characteristics	Building Level								Total	
	Elementary		Middle		High School		Multiple Levels			
	N	%	N	%	N	%	N	%	N	%
Gender										
Male	6	13.3	6	26.1	11	36.7	2	28.6	25	23.8
Female	39	86.7	17	73.9	19	63.3	5	71.4	80	76.2
Age										
Under 30	4	8.9	4	17.4	7	23.3	3	42.9	18	17.1
31 to 40	9	20.0	2	8.7	5	16.7	1	14.3	17	16.2
41 to 50	21	46.7	15	65.2	9	30.0	1	14.3	46	43.8
51 to 60	11	24.4	2	8.7	9	30.0	2	28.6	24	22.9
Marital Status										
Single	4	8.9	3	13.0	8	26.7	2	28.6	17	16.2
Married	37	82.2	19	82.6	19	63.3	5	71.4	80	76.2
Widowed	1	2.2	0	0.0	0	0.0	0	0.0	1	1.0
Divorced	3	6.7	1	4.3	3	10.0	0	0.0	7	6.7
Number of Children										
None	8	17.8	6	26.1	13	43.3	4	57.1	31	29.5
One	9	20.0	7	30.4	2	6.7	2	28.6	20	19.0
Two	10	22.2	8	34.8	12	40.0	0	0.0	30	28.6
Three	15	33.3	2	8.7	1	3.3	1	14.3	19	18.1
Four	3	6.7	0	0.0	1	3.3	0	0.0	4	3.8
Five	0	0.0	0	0.0	1	3.3	0	0.0	1	1.0

The majority of the respondents (n=80, 76.2%) were female. Twenty-five (23.8%) teachers were male. Three respondents did not provide a response to this question. Of the 45 elementary teachers in the study, 39 (86.7%) were female and 6 (13.3%) were male. Six (26.1%) middle school teachers indicated their gender was female, with 17 (73.9%) middle school teachers reporting their gender as male. Thirty high school teachers were included in the study, 11 (36.7%) reporting their gender as male and 19 (63.3%) indicating their gender as female. Two (28.6%) teachers who were assigned to multiple levels were male, with 5 (71.4%) reporting their gender as female.

Eighteen (16.8%) participants were under 30 years old, with 17 (16.2%) indicating they were between 31 and 40 years of age. Forty-six (43.8%) of the teachers

were between 41 and 50 years of age, while 24 (22.94%) were between 51 and 60 years of age. Three respondents did not provide a response to this question.

The largest number of teachers at the elementary level (n=21, 46.7%) was between 41 and 50 years of age, with 11 (24.4%) reporting their age as between 51 and 60 years. Nine (20.0%) elementary teachers were between 31 and 40, with 4 (8.9%) reporting their ages as under 30.

Fifteen (65.2%) middle school teachers were between 41 and 50 years of age, with 4 (17.4%) indicating their ages were under 30. Two (8.7%) teachers at the middle school were between 31 and 40, with 2 (8.7%) indicating they were between 51 and 60 years of age.

Nine (30.0%) high school teachers were each between the ages of 41 and 50 years and 51 and 60 years. Seven (23.3%) high school teachers were under 30 years and 5 (16.7%) were between 31 and 40 years of age.

Seven teachers were assigned to multiple levels within the school district. Of these 7 teachers, 3 (42.9%) were under 30, with 2 (28.6%) reporting their ages as between 51 and 60 years. One (14.3%) teacher was each between 31 and 40 years and 1 (14.3%) was between 41 and 50 years.

The majority of the respondents (n=80, 76.2%) reported their marital status as married, with 17 (16.2%) indicating their marital status as single. One (1.0%) was widowed, with 7 (6.7%) reporting their marital status as divorced. Three teachers did not provide a response to this question.

The majority of the elementary teachers (n=37, 82.2%) reported their marital status as married. Nineteen (82.6%) middle school teachers were married, as were 19 (63.3%) of the high school teachers. Five (71.4%) teachers, who were assigned to

multiple levels, were married. Four (8.9%) elementary teachers were single, with 3 (13.0%) middle school teachers indicating they were also single. Eight (26.7%) high school teachers were single, as were 2 (28.6%) of the teachers who were assigned to multiple levels within the school district.

The largest group of teachers (n=31, 29.5%) indicated they had no children, with 30 (28.6%) reporting two children. Twenty (19.0%) teachers had one child and 19 (18.1%) had three children. Four (3.8%) teachers had four children, with 1 (1.0%) teacher indicating s/he had five children.

The largest number of elementary school teachers (n=15, 33.3%) had three children, 8 (17.8%) teachers reporting they had no children Nine (20.0%) elementary teachers had one child and 10 (22.2%) indicated they had two children. Three (6.7%) elementary school teachers had four children. Six (26.1%) middle school teachers had no children, with 7 (30.4%0 reporting they had one child. Eight (34.8%) middle school teachers reported they had two children, and 2 (8.7%) had three children. Thirteen (43.3%) high school teachers had no children. Two (6.7%) high school teachers had one child, with 12 (40.0%) reporting they had two children. One (3.3%) high school teacher each had three, four, and five children. Four (57.1%) teachers assigned to multiple levels reported they had no children. Two (28.6%) teachers assigned to multiple levels had one child, with 1 (14.3%) reporting they had three children.

Professional Characteristics

The teachers' professional characteristics were also obtained on the survey. The professional characteristics included; educational level, current teaching status, subject taught, and teaching in area of certification. The responses to these questions were crosstabulated by building level for presentation in Table 5.

Table 5

Professional Characteristics of the Teachers by Building Level (N=108)

Characteristics	Building Level								Total	
	Elementary		Middle		High School		Multiple Levels			
	N	%	N	%	N	%	N	%	N	%
Educational Level										
Bachelor's	14	31.1	10	43.5	8	26.7	2	28.6	34	32.4
Master's	30	66.7	12	52.2	21	70.0	5	71.4	68	64.8
Ed. Specialist	1	2.2	1	4.3	1	3.3	0	0.0	3	2.9
Current Teaching Status										
Full-time substitute	1	2.2	0	0.0	0	0.0	0	0.0	1	1.0
Part-time teacher	1	2.2	0	0.0	0	0.0	0	0.0	1	1.0
Full-time contract teacher	40	88.9	21	91.3	29	96.7	6	85.7	96	91.4
Other	3	6.7	2	8.7	1	3.3	1	14.3	7	6.7
Subject Taught										
Elementary (all subjects)	36	33.7	0	0.0	0	0.0	1	16.7	37	37.4
Language Arts	0	0.0	7	33.4	8	26.7	2	33.3	17	17.2
Special Education	3	7.1	4	19.0	3	10.0	1	16.7	11	11.1
Science	0	0.0	4	19.0	4	13.3	0	0.0	8	8.1
History	0	0.0	4	19.0	3	10.0	0	0.0	7	7.1
Math	0	0.0	1	4.8	4	13.3	2	33.3	7	7.1
Vocational	0	0.0	0	0.0	3	10.0	0	0.0	3	3.0
Counselor/Social Work	2	4.8	0	0.0	1	3.3	0	0.0	3	3.0
Physical Education	1	2.4	0	0.0	1	3.3	0	0.0	2	2.0
Art	0	0.0	1	4.8	1	3.3	0	0.0	2	2.0
Computers	0	0.0	0	0.0	1	3.3	0	0.0	1	1.0
Library Media	0	0.0	0	0.0	1	3.3	0	0.0	1	1.0
Teaching in Area of Certification										
Yes	45	100.0	20	87.0	29	96.7	7	100.0	101	96.2
No	0	0.0	2	8.7	0	0.0	0	0.0	2	1.9
Other	0	0.0	1	4.3	1	3.3	0	0.0	2	1.9

The majority of the teachers (n=68, 64.8%) indicated they had completed a master's degree, with 34 (32.4%) reporting they had a bachelor's degree. Three (2.9%) teachers indicated they had obtained an educational specialist degree. Of the 45 elementary teachers who provided their educational level, 30 (66.7%) had a master's degree, with 14 (31.1%) reporting a bachelor's degree. One (2.2%) elementary teacher reported his/her highest level of education completed was an educational specialist certificate. Twelve (52.2%) middle school teachers had completed a master's degree and

10 (43.5%) had obtained a bachelor's degree. One (4.3%) middle school teacher had completed an educational specialist degree. Of the 30 high school teachers in the study, 21 (70.0%) had a master's degree as their highest level of education, with 8 (26.7%) reporting they had completed a bachelor's degree. One (3.3%) teacher had received an educational specialist degree. Five (71.4%) teachers who were at the multiple levels had obtained a master's degree, with 2 (28.6%) indicating their highest level of completed education was a bachelor's degree.

The majority of the teachers (n=96, 91.4%) reported their employment status as full-time contract teacher. One (1.0%) teacher each reported their employment status as full-time substitute and part-time teacher. Forty (88.9%) teachers at the elementary level were full-time contract teachers, with 21 (91.3%) teachers at the middle school and 29 (96.7%) high school teachers reporting they were full-time contract teachers. Six (85.7%) teachers at multiple levels were full-time contract teachers.

The subjects taught included all subjects (n=37, 37.4%) and language arts (n=17, 17.2%). Eleven (11.1%) teachers were teaching in special education programs. Science was the teaching area of 8 (8.1%) teachers and history and math were being taught by 7 (7.1%) participants. Three (3.0%) respondents were teaching in either vocational or counselor/social work areas. Two (2.0%) teachers were each teaching physical education or art. One (1.0%) participant taught computers and 1 (1.0%) respondent was in the library media.

The majority of the teachers (n=101, 96.2%) were teaching in the area of their certification. Forty-five (100.0%) elementary teachers, 20 (87.0%) middle school teachers, 29 (96.7%) high school teachers, and 7 (100.0%) teachers at multiple levels were teaching in the area of their certification. Two (8.7%) middle school teachers were

not teaching in the area of their certification. One (4.3%) middle school teacher and 1 (3.3%) high school teacher indicated "other" as their response, without providing additional explanation on their responses.

Educational experiences of the teachers were obtained on the survey. Their responses were provided in the actual number of years they had been in education and the number of years they had been in their current position. Their responses were summarized using descriptive statistics. Table 6 presents the results of these analyses.

Table 6

A Description of Respondents' Experiences in Education (N=108)

Experience	Number	Mean	SD	Median	Range	
					Minimum	Maximum
Years in Education (Total)	105	14.00	9.84	18.00	1	35
Elementary School	45	17.71	8.88	17.00	1	35
Middle School	23	17.91	9.37	22.00	2	32
High School	30	17.83	10.69	18.50	1	33
Multiple Levels	7	14.00	14.46	7.00	1	35
Years in Current Position	104	11.22	8.88	9.00	1	31
Elementary School	44	10.59	7.11	9.50	1	30
Middle School	23	10.78	8.90	10.00	1	28
High School	30	13.73	11.08	9.00	1	31
Multiple Levels	7	5.86	6.12	5.00	1	18

The mean number of years in education was 14.00 (sd=9.84), with a median of 18 years. The range of years in current practice was from 1 to 35 years. The range of years in education was from 1 to 31 years, with a median of 9 years. Teachers at the elementary school level had been in education for a mean of 17.71 (sd=8.88) years. The range of experience in education for elementary teachers was from 1 to 35 years, with a median of 17 years. Middle school teachers' experience in education ranged from 2 to 32 years, with a median of 22 years. The middle school teachers had a mean of 17.91 (sd=9.37) years in

education. The average number of years that high school teachers had been in education was 17.83 (sd=10.69) years, with a median of 18.50 years. The range of years of experience in education for high school teachers was from 1 to 35 years. Teachers who were at multiple levels had experience in education that ranged from 1 to 35 years. The mean number of years these teachers had in education was 14.00 (sd=14.46), with a median of 7 years.

The mean number of years in current position was 11.22 (sd=8.88) years. The median number of years teachers had been in their current position was 9 years, with a range from 1 to 31 years. Elementary teachers had been in their current positions for a mean of 10.59 (sd=7.11) years, with a median of 9.50 years. The range of experience in their current position ranged from 1 to 30 years. Middle school teachers had been in their current positions from 1 to 28 years, with a median of 10 years. The mean number of years middle school teachers had been in their current positions was 10.78 (sd=8.90) years. High school teachers had been in their current positions an average of 13.73 (sd=11.08) years, with a median of 9.00 years. The range of experience of high school teachers in their current positions was from 1 to 31 years. The range of experience of teachers at multiple levels was from 1 to 18 years, with a median of 5 years. The mean experience for teachers at multiple levels was 5.86 (sd=6.12) years.

Computer Experiences

Teachers were asked to relate their experiences with computers, including their access to computers at home, in the classroom, in other places, and their self-reported skill with computers. Table 7 presents the results of the crosstabulation of the teachers' responses by their building levels.

Table 7

Computer Experiences by Building Level (N=108)

Characteristics	Building Level								Total	
	Elementary		Middle		High School		Multiple Levels			
	N	%	N	%	N	%	N	%	N	%
Home Access										
Yes	26	57.8	18	78.3	22	73.3	5	71.4	71	67.6
No	19	42.2	5	21.7	8	26.7	2	28.6	34	32.4
Classroom Access										
Yes	40	88.9	17	73.9	21	70.0	5	71.4	83	79.0
No	5	11.1	6	26.1	9	30.0	2	28.6	22	21.0
Other Access										
Yes	8	17.8	4	17.4	5	16.7	3	42.9	20	19.0
No	37	82.2	19	82.6	25	83.3	4	57.1	85	81.0
Self-Reported Computer Skills										
Poor	2	4.4	1	4.3	1	3.3	0	0.0	4	3.8
Fair	22	48.9	7	30.4	13	43.3	4	57.1	46	43.8
Good	17	37.9	8	34.9	11	36.7	2	28.6	38	36.2
Excellent	4	8.9	7	30.4	5	16.7	1	14.3	17	16.2

The majority of the respondents (n=71, 67.6%) indicated they had access to computers at home. Twenty-six (57.8%) elementary teachers, 18 (78.3%) middle school teachers, 22 (73.3%) high school teachers, and 5 (71.4%) teachers at multiple levels reported they had access to computers at home.

When asked about classroom access, 83 (79.0%) teachers reported they had computers in their classrooms. A total of 40 (88.9%) elementary teachers, 17 (73.9%) middle school teachers, 21 (70.0%) high school teachers, and 5 (71.4%) teachers at multiple levels reported they had access to computers in their classrooms.

Twenty (19.0%) teachers had access to computers in places other than home or in the classroom. Eight (17.8%) of these teachers were at the elementary school level; with 4 (17.4%) middle school, 5 (16.7%) high school, and 3 (42.9%) teachers at multiple levels.

The teachers were asked to rate their computer skills using a four-point scale

ranging from poor to excellent. Based on their responses, 46 (43.8%) rated their skills as fair and 38 (36.2%) indicated their skills were good. Seventeen (16.2%) reported their computer skills were excellent, while 4 (3.8%) indicated they had poor computer skills. Among the elementary school teachers, the ratings included 2 (4.4%) poor, 22 (48.9%) fair, 17 (37.9%) good, and 4 (8.9%) excellent. Seven (30.4%) middle school teachers rated their computer skills as excellent, with 8 (34.9%) rating their skills as good. Seven (30.4%) middle school teachers rated their computer skills as fair and 1 (4.3%) indicated his/her computer skills were poor. Five (16.7%) high school teachers rated their computer skills as excellent and 11 (36.7%) rated their skills as good. Thirteen (43.3%) high school teachers indicated they had fair computer skills and 1 (3.3%) rated their skills as poor. Among teachers at multiple levels, 1 (14.3%) rated his/her computer skills were excellent, 2 (28.6%) were good, and 4 (57.1%) were fair. None of the teachers at multiple levels reported their computer skills as poor.

The teachers were asked to report the number of years they had been using a computer. Their responses were summarized using descriptive statistics. The results of this analysis are presented in Table 8.

Table 8

A Description of Respondents'
Number of Years Using a Computer in Education (N=108)

Years Using a Computer	Number	Mean	SD	Median	Range	
					Minimum	Maximum
Elementary	42	6.33	3.47	5.50	0	12
Middle School	22	5.77	3.77	5.00	0	15
High School	30	7.23	5.21	8.00	0	17
Multiple Levels	7	6.86	5.52	5.00	0	15
Total	101	6.51	4.23	6.00	0	17

The mean number of years that teachers had been using computers was 6.51

(sd=4.23) years, with a median of 6 years. The range of years using a computer was from none to 17 years. Elementary teachers had been using computers for an average of 6.33 (sd=3.47) years, with a median of 5.50 years. Elementary school teachers had been using computers from 0 to 12 years. The middle school teachers had been using computers from 0 to 15 years, with a median of 5.00 years. The mean experience with computers for middle school teachers was 5.77 (sd=3.77) years. High school teachers had been using computers an average of 7.23 (sd=5.21) years. The range of experience among the high school teachers was from 0 to 17 years, with a median of 8 years. Teachers at multiple levels had been using computers for an average of 6.86 (sd=5.52) years, with a median of 5.00 years. Their experiences with computers ranged from 0 to 15 years.

Computer Attitudes, Self-Efficacy, and Innovativeness

Descriptive data were obtained for each of the continuous variables measuring computer attitudes; computer anxiety, computer confidence, computer liking, and computer usefulness; general self-efficacy, social self-efficacy, and innovativeness. These variables were summarized by level of the teachers. Table 9 presents the results of the analysis for computer attitudes.

Table 9

A Description of Respondents' Computer Attitudes (N=108)

Continuous Variables	Number	Mean	SD	Median	Range	
					Minimum	Maximum
Computer Anxiety	100	31.69	5.25	31	12	40
Elementary School	42	31.64	5.20	30	12	40
Middle School	22	30.27	5.63	30	17	39
High School	29	33.21	4.75	33	19	38
Multiple Levels	7	30.14	5.67	31	18	39
Computer Confidence	100	30.26	5.40	29	12	40
Elementary School	42	30.40	5.20	29.50	12	40
Middle School	22	28.36	5.76	28	17	39
High School	29	31.83	4.88	32	19	38
Multiple Levels	7	28.86	6.41	28	18	39
Computer Liking	100	29.53	5.46	30	16	40
Elementary School	43	29.70	5.02	30	16	40
Middle School	22	28.45	5.37	28	19	39
High School	28	30.39	6.38	30.50	18	40
Multiple Levels	7	28.43	4.69	27	23	40
Computer Usefulness	100	31.27	4.99	31.50	18	40
Elementary School	43	30.52	4.82	31.50	18	40
Middle School	22	31.14	4.94	31	22	39
High School	28	32.38	5.32	32	20	40
Multiple Levels	7	31.57	4.79	30	25	40

Missing 8

Computer Attitudes

The Computer Attitude Scale (Loyd & Gresard, 1984) was divided into four subscales: computer anxiety, computer confidence, computer liking, and computer usefulness. The respondents were described in terms of each of these subscales.

Computer anxiety. The mean score for computer anxiety was 31.69 (sd=5.25), with a median of 31. Actual scores ranged from 12 to 40. Possible scores on this scale could range from 10 to 40, with higher scores reflecting lower levels of computer anxiety.

Computer confidence. The actual scores on computer confidence ranged from 12 to 40, with a median of 29. The mean score on this subscale was 30.26 (sd=5.40). Possible scores on this subscale could range from 10 to 40 with higher scores indicating higher levels of confidence in using computers.

Computer liking. The mean score on computer liking was 29.53 (sd=5.46), with a median of 30. Actual scores on this subscale ranged from 16 to 40. Possible scores on this subscale could range from 10 to 40, with higher scores reflecting higher levels of liking computers.

Computer usefulness. Actual scores on computer usefulness ranged from 18 to 40, with a median score of 31.50. The mean score on this subscale was 31.27 (sd=4.99). Possible scores on this subscale could range from 10 to 40, with higher scores indicating more positive perceptions regarding computer usefulness.

Self-Efficacy

Self-efficacy was divided into two subscales: general and social self-efficacy. Descriptive data were obtained for each of these variables. Table 10 presents these data.

Table 10

A Description of Respondents' Self-Efficacy and Innovativeness

Self-Efficacy and Innovativeness	Number	Mean	SD	Median	Range	
					Minimum	Maximum
General Self-Efficacy	100	64.84	5.24	65	51	77
Elementary School	43	65.28	4.94	65	55	76
Middle School	22	63.09	4.49	63.50	56	75
High School	28	65.71	5.67	66	51	77
Multiple Levels	7	64.14	7.01	65	52	72
Social Self-Efficacy	104	20.44	3.01	21	12	26
Elementary School	45	20.71	2.54	20	12	26
Middle School	22	19.68	2.68	19	13	23
High School	30	19.97	3.76	21	12	26
Multiple Levels	7	23.14	1.68	23	21	26
Innovativeness	101	99.52	14.87	100	67	133
Elementary School	42	102.00	14.14	103.50	73	133
Middle School	22	96.82	15.95	95	67	129
High School	30	96.90	15.16	99.50	68	131
Multiple Levels	7	104.42	13.66	100	85	123

General self-efficacy. The mean score for general self-efficacy was 64.84 (sd=5.24), with a median of 65. Actual scores on this subscale ranged from 51 to 77.

Possible scores on this measurement of self-efficacy ranged from 17 to 85, with a neutral point of 51. The neutral point was obtained by multiplying the number of items on the subscale (items=17) times the value of "3", the numerical value assigned to a neutral response. Scores greater than 51 were indicative of positive self-efficacy, while scores less than 51 reflecting negative self-efficacy.

Social self-efficacy. The mean score on social self-efficacy was 20.44 (sd=3.01), with a median of 21. The range of actual scores was from 12 to 26. Possible scores on this subscale which included 6 items could range from 6 to 30, with a neutral point of 18. Scores greater than 18 indicated positive levels of social self-efficacy and scores less than 18 were reflective of low levels of social self-efficacy.

Innovativeness

The mean score for innovativeness was 99.52 (sd=14.87), with a median of 100. The range of scores was from 67 to 133. Actual scores on this scale could range from 20 to 140 with scores closer to 140 indicating higher levels of innovativeness. Elementary school teachers had a mean score of 102.00 (sd=14.14), with a median of 103.50. The scores on innovativeness for elementary school teachers was from 73 to 133. The range of scores on innovativeness for middle school teachers ranged from 67 to 129, with a median score of 95. The mean score on innovativeness for middle school teachers was 96.82 (sd=15.95). The high school teachers had a mean score of 96.90 (sd=15.16), with a median score of 99.50. The scores on innovativeness for high school teachers ranged for 68 to 131. The mean score on innovativeness for teachers at multiple levels was 104.42 (sd=13.66), with a median score of 100. The range of scores for teachers at multiple levels was from 85 to 123.

Intended Use of Computers

The teachers were asked if they intended to use computers for personal use, classroom instruction, and classroom management. Three items on the survey were used to obtain information on each of these subscales. The responses to these items were summed and a mean score was obtained on the three subscales for each respondent. Descriptive statistics were obtained on the three subscales for presentation in Table 11.

Table 11

A Description of Respondents' Intended Use of Computers (N=108)

Intended Use	Number	Mean	SD	Median	Range	
					Minimum	Maximum
Intended Use – Personal	78	5.56	2.66	6	0	9
Elementary School	35	5.86	2.53	6	0	9
Middle School	13	4.54	3.04	6	0	8
High School	25	5.80	2.58	6	0	9
Multiple Levels	5	5.00	2.92	6	0	7
Intended Use – Classroom Instruction	81	6.32	2.45	6	0	9
Elementary School	35	7.20	2.18	8	0	9
Middle School	17	5.24	2.82	5	0	9
High School	24	6.13	1.83	6	0	9
Multiple Levels	5	4.80	3.70	4	0	9
Intended Use – Classroom Management	79	5.06	3.11	6	0	9
Elementary School	35	5.23	2.85	5	0	9
Middle School	16	4.13	3.67	5	0	9
High School	23	5.48	2.91	6	0	9
Multiple Levels	5	5.00	4.30	6	0	9

Intended Personal Use of Computers. The mean score for intended personal use of computers was 5.56 (sd=2.66), with a median of 6. Actual scores on this subscale ranged from 0 to 9 with higher scores reflecting higher levels of intended use. Elementary school teachers had a mean score of 5.86 (sd=2.53), with a median score of 6. Their scores ranged from 0 to 9. Middle school teachers' scores on intended personal use of computers ranged from 0 to 8 with a median of 6. The mean score for middle school

teachers was 4.54 (sd=3.04). High school teachers had a mean score of 5.80 (sd=2.58), with a median of 6.00. The range of scores on this subscale was from 0 to 9. Teachers at multiple levels had a mean score of 5.00 (sd=2.92), with a median of 6.00 for intended personal use of computers. The range of scores on this measure of computer use ranged from 0 to 7.

Intended Use – Classroom Instruction. The mean score on intended use of computers for classroom instruction was 6.32 (sd=2.45), with a median of 6.00. The actual scores on intended use of computers for classroom instruction ranged from 0 to 9. Possible scores on this subscale could range from 0 to 9 with higher scores indicating greater intended use of computers for classroom instruction. The mean score for elementary school teachers on intended use of computers for classroom instruction was 7.20 (sd=2.18), with a median of 8. Scores on this subscale ranged from 0 to 9. Middle school teachers had a mean score of 5.24 (sd=2.82), with a median of 5.00 for intended use of computers for classroom instruction. Actual scores on this subscale ranged from 0 to 9. The range of scores on intended use of computers for classroom instruction was from 0 to 9, with a median of 6. The mean score on this subscale was 6.13 (sd=1.83) for high school teachers. Teachers at multiple levels had a mean score of 4.80 (sd=3.70) on intended use of computers for classroom instruction, with a median of 6.00. Scores on this subscale ranged from 0 to 9.

Intended Use – Classroom Management. The mean score for intended use of computers for classroom management was 5.06 (sd=3.11), with a median of 6.00. The actual scores on this subscale could range from 0 to 9, with higher scores reflecting teachers were more positive about intending to use computers for classroom management. The elementary teachers had a mean score of 5.23 (sd=2.85), with a median of 5.00. The

scores on this subscale ranged from 0 to 9. Middle school teachers had a median of 5, with a range of scores from 0 to 9 for intended use of computers for classroom management. The mean score on this subscale was 4.13 (sd=3.67) for middle school teachers. High school teachers had a mean score of 5.48 (sd=2.91), with a median of 6. The scores on intended use of computers for classroom management ranged from 0 to 9 for high school teachers. Teachers at multiple levels had a median score of 6.00, with scores ranging from 0 to 9 on intended use of computers for classroom management. The mean score for these teachers was 5.00 (sd=4.30) on intended use of computers for classroom management.

Research Questions

Seventeen research questions were developed to test the model designed for this study. The questions were clustered by type. These research questions were tested using stepwise multiple linear regression analyses. All decisions on the statistical significance of the findings were made using an alpha level of .05.

Attitudes Toward Computers, Self-Efficacy, and Innovativeness with Personal Characteristics

Research question 1. What is the relationship between personal characteristics of teachers and their attitudes toward computers?

The relationship between the personal characteristics of teachers and their attitudes toward computers was tested using a stepwise multiple regression analysis. The personal characteristics included age, gender, marital status, and number of dependent children. The variables that were not continuous (e.g., marital status) were dummy coded to meet the assumptions of regression analyses. Computer attitudes were measured with four separate components: anxiety, confidence, liking, and usefulness.

The four measures of computer attitudes were used as dependent variables in

separate stepwise multiple linear regression analyses. The personal characteristics of the teachers were used as the independent variables. Table 12 presents the results of this analysis.

Table 12

The Relationship Between
Computer Confidence and Personal Characteristics (N=108)

Predictor Variable	Constant	b Weight	Beta	r^2	t-Value	p
Computer Confidence						
Age of Teacher	33.07	-1.05	-.20	.04	-2.01	.047
Computer Usefulness						
Age of Teacher	34.86	-1.33	-.27	.07	-2.83	.006

Computer anxiety. The first analysis used computer anxiety as the dependent variable. None of the variables entered the regression equation, indicating that personal characteristics were not significant predictors of computer anxiety.

Computer confidence. When computer confidence was used as the dependent variable, one personal characteristic, age of the teacher, entered the equation as a significant predictor of computer confidence, accounting for 4.0% of the variance in computer confidence.

Computer liking. None of the personal characteristics; age, gender, marital status, and number of children; entered the stepwise multiple linear regression analysis, indicating they were not significant predictors of computer liking.

Computer usefulness. The age of the teacher entered the stepwise multiple linear regression analysis, explaining 7% of the variance in computer usefulness.

Based on the findings of these analyses, computer attitudes appeared to be influenced by the age of the teacher. Younger teachers were more likely to have more

computer confidence and were more likely to perceive the computer as useful. None of the personal characteristics of the teachers were related to their perceptions of computer anxiety or computer liking.

> *Research question 2.* What is the relationship between personal characteristics of teachers and their level of self-efficacy?

Self-efficacy was divided into two subscales, general and social. Each of these subscales were used as dependent variables in a stepwise multiple linear regression analysis, with the personal characteristics of the teachers; age, gender, martial status, and number of children; used as the independent variables. None of the independent variables entered the stepwise multiple linear regression analyses for either general and social self-efficacy. Based on these findings, personal characteristics do not appear to be related to general and social self-efficacy for teachers.

> *Research question 3.* What is the relationship between personal characteristics of teachers and their extent of innovativeness?

The teachers' scores on the innovativeness scale were used as the dependent variable in a stepwise multiple linear regression analysis. The independent variables in this study were the personal characteristics of the teachers, including: age, gender, marital status, and number of dependent children. None of the personal characteristics entered the stepwise multiple linear regression analysis, indicating personal characteristics of the teachers were not significant predictors of innovativeness.

Attitudes Toward Computers, Self-Efficacy, and Innovativeness with Professional Characteristics

> *Research question 4.* What is the relationship between professional characteristics of teachers and their attitudes toward computers?

Stepwise multiple linear regression analysis was used to determine which professional characteristics of teachers could be used to predict attitudes toward

computers. Four separate stepwise multiple linear regression analyses were used to determine predictors of computer anxiety, computer confidence, computer liking, and computer usefulness. The professional characteristics of the teachers included level of education, building level of the teacher, years in education, and years in present position. The building level of the teacher was dummy coded to allow its use in the stepwise multiple linear regression analysis. Table 13 presents the results of this analysis.

Table 13

The Relationship Between
Computer Confidence and Professional Characteristics (N=108)

Predictor Variable	Constant	b Weight	Beta	r^2	t-Value	p
Computer Confidence						
Number of years in education	32.43	-.13	-.25	.06	-2.57	.012
Computer Usefulness						
Number of years in education	30.88	-.19	-.39	.11	-4.06	<.001
Level of education		2.15	.23	.05	2.37	.020

Computer anxiety. When computer anxiety was used as the dependent variable, none of the professional characteristics entered the regression equation.

Computer confidence. One variable, number of years of education, entered the stepwise multiple linear regression analysis explaining 6% of the variance in computer confidence.

Computer liking. None of the professional characteristics entered the stepwise multiple linear regression analysis, indicating level of education, building level of the teacher, years in education, and years in current position were not predictors of computer liking.

Computer usefulness. Two independent variables, number of years in education and level of education, entered the stepwise multiple linear regression analysis,

explaining 16% of the variance in computer usefulness.

Based on these findings, computer attitudes, as measured by computer confidence and computer usefulness, can be predicted from years in education, with computer usefulness also predicted from level of education. Teachers with fewer years of teaching experience were more likely to have higher levels of computer confidence and usefulness. Increased perceptions regarding the usefulness of computers is associated with teachers with higher levels of education. Computer anxiety and computer liking were not predicted by professional characteristics of the teachers.

Research question 5. What is the relationship between professional characteristics of teachers and their level of self-efficacy?

The professional characteristics of the teachers, including educational level, building level, number of years in education, and number of years in current positions were used as the independent variables in a stepwise multiple linear regression analysis. The scores on general self-efficacy were used as the dependent variable in this analysis. None of the independent variables entered the regression equation, indicating they were not significant predictors of general self-efficacy.

The summed scores on social self-efficacy were used as the dependent variable in a stepwise multiple linear regression analysis, with professional characteristics of teachers used as the independent variables in this analysis. None of the professional characteristics entered the stepwise regression analyses, indicating that educational level, teaching level, years in education, and years in current position were not predictors of levels of social self-efficacy.

These findings showed that professional characteristics of teachers were not predictors of either general or social self-efficacy.

Research question 6. What is the relationship between professional characteristics of teachers and their extent of innovativeness?

The professional characteristics of teachers; including educational level, teaching level, years in education, and years in current position; were used as independent variables in a stepwise multiple linear regression analyses. The scores on innovation were used as the dependent variable in this analysis. None of the independent variables entered the regression equation, indicating that professional characteristics were not significant predictors of teacher innovation.

Attitudes Toward Computers, Self-Efficacy, and Innovativeness with Previous Experience with Computers

Research question 7. What is the relationship between teachers' previous computer experience and their attitudes toward computers?

Computer experience, including access to computers at home, in their classroom, and in other places, the number of years they have been using a computer, and their self-reported computer skill, were used as independent variables in a stepwise multiple linear regression analysis. The four measures of computer attitudes; computer anxiety, computer confidence, computer liking, and computer usefulness; were used as dependent variables in separate regression analyses. The results of the stepwise multiple linear regression analyses for these dependent variable are presented in Table 14.

Table 14

The Relationship Between
Computer Anxiety and Computer Experiences (N=108)

Predictor Variable	Constant	b Weight	Beta	r^2	t-Value	P
Computer Anxiety						
Years using a computer	32.74	.43	.37	.23	3.96	<.001
Self-reported computer skill@		-1.38	-.28	.07	-2.99	.004
Computer Confidence						
Self-reported computer skill@	32.87	-1.98	-.40	.29	-4.70	<.001
Years using a computer		.45	.38	.13	4.53	<.001
Computer Liking						
Self-reported computer skill@	32.53	-1.91	-.36	.21	-3.88	<.001
Years using a computer		.34	.27	.07	2.90	.005
Computer Usefulness						
Years using a computer	32.02	.45	.38	.25	4.13	<.001
Self-reported computer skill@		-1.35	-.28	.06	-2.97	.004

@Lower scores reflect higher self-reported computer skills

Computer Anxiety. Two independent variables, years using a computer and self-reported computer skill, entered the stepwise multiple linear regression analysis, explaining 29% of the variation in computer anxiety. The years using a computer entered the regression equation first, explaining 23% of the variation in computer anxiety. The t-value of 3.97 obtained for this variable was statistically significant at an alpha level of .05. This finding indicated that the amount of variation in computer anxiety that was explained by years of computer experience was statistically significant. The positive value of the relationship, indicated that higher scores on computer anxiety (indicating lower anxiety levels) were associated with more years of computer experience. The self-reported computer skill level of the teacher entered the regression equation, explaining an additional 7% of the variation in computer anxiety. The t-value of -2.99 was statistically significant at an alpha level of .05, indicating that the self-reported skill level of the teacher was explaining a significant amount of variation in computer anxiety. The negative value of the relationship showed that teachers who reported more competent

skills in the use of computers had lower levels of computer anxiety.

Computer Confidence. Self-reported computer skill and years using a computer entered the stepwise multiple linear regression analysis, explaining 42% of the variation in computer confidence. Self-reported computer skill explained 29% of the variation in computer confidence. The t-value of -4.70 was statistically significant at an alpha level of .05, indicating the amount of variation in computer confidence that was explained by self-reported computer skill was statistically significant. The negative value of the relationship between these two variables showed that higher levels of self-reported computer skill (lower scores indicated greater skill levels) were associated with higher levels of computer confidence. The years using a computer explained an additional 13% of the variation in computer confidence. The t-value of 4.53 for this independent variable was statistically significant at an alpha level of .05, indicating that years of computer experience were explaining a significant amount of variation in computer confidence. Teachers who reported they had been using computers for a longer period of time had higher scores on computer confidence.

Computer Liking. Self-reported computer skill and years using a computer entered the regression equation, explaining 28% of the variance in scores for computer liking. Self-reported computer skill entered the regression equation first, explaining 21% of the variance in computer liking. The associated t-value of -3.88 was statistically significant, indicating a significant amount of variation in computer liking was explained by self-reported computer skills. The negative value of the relationship indicated that teachers who reported higher levels of computer skills tended to like computers better. Years using a computer explained an additional 7% of the variation in computer liking. The t-value of 2.90 for this independent variable was statistically significant at an alpha level of .05,

indicating the amount of variance that was explained by years using a computer was statistically significant. The relationship between years using a computer and computer liking was positive, indicating people who reported higher levels of computer liking had been using computers for longer periods of time.

Computer Usefulness. Two variables, years using a computer and self-reported computer skill, entered the stepwise multiple linear regression equation, explaining 31% of the variance in computer usefulness. The first independent variable, years using a computer, explained 25% of the variance in computer usefulness. The associated t-value of 4.13 for this variable was statistically significant, indicating the amount of variance in computer usefulness that was explained by years using a computer was statistically significant. The positive value of the relationship between these two variables indicated that teachers who had been using a computer for longer periods of time were more likely to find computers useful. Self-reported computer skills entered the regression equation, explaining an additional 6% of the variance in self-reported computer skill. The t-value of -2.97 obtained on this analysis was statistically significant at an alpha level of .05. Because lower scores on self-reported computer skills reflected perceptions of greater proficiency in using computers, the negative value of the relationship showed that teachers who reported higher levels of computer skills were more likely to find computers useful.

Based on the findings of these analyses, self-reported computer skills and years using a computer were significant predictors of the four subscales measuring attitudes regarding computers. These variables reflect experiences with computers and higher self-reported computer skills result in better attitudes regarding the use of computers.

Research question 8. What is the relationship between teachers' previous

computer experience and their level of self-efficacy?

Research question 9. What is the relationship between teachers' previous computer experience and their extent of innovativeness?

The scores on general and social self-efficacy and innovation were used as dependent variables in separate stepwise multiple linear regression analyses. The independent variables measuring previous computer experiences were used as the independent variable in these analyses. Previous computer experiences included access to computers at home, access to computers in the classroom, and other access to computers, years using a computer, and self-reported computer skill. The results of these analyses are presented in Table 15.

Table 15

The Relationship Between
General and Social Self-Efficacy and Computer Experiences (N=108)

Predictor Variable	Constant	b Weight	Beta	r^2	t-Value	P
General Self-Efficacy						
Self-reported computer skill	68.17	-1.21	-.28	.08	-2.99	.003
Social Self-efficacy						
No variables entered						
Innovation						
Years using a computer	92.61	1.07	.31	.09	3.33	.001

General Self-Efficacy. One variable, self-reported computer skill, entered the stepwise multiple linear regression, explaining 8% of the variance in general self-efficacy. The negative value of the relationship between self-reported computer skills and general self-efficacy indicated that teachers who reported higher levels of computer skills were likely to have higher levels of general self-efficacy. The remaining independent variables did not enter the regression equation, indicating they were not significant

predictors of general self-efficacy.

Social Self-Efficacy. None of the independent variables entered the regression equation, indicating they were not significant predictors of social self-efficacy.

Innovation. The independent variable, years using a computer, entered the stepwise multiple linear regression, explaining 9% of the variance in innovation.

These analyses showed that most of the professional variables were not predictors of self-efficacy. General self-efficacy appeared to be positively influenced by how good an individual rated his/her computer skills. Increased experience with computers was more likely to be related to increased innovation by teachers.

Intended Use of Computers with Computer Attitudes, Self-efficacy, and Innovation

Research question 10. What is the relationship between teachers' computer attitudes and their intended use of computers?

A stepwise multiple linear regression was used to determine if teachers' computer attitudes; anxiety, confidence, liking, and usefulness; could be used to predict teachers' intended personal use of computers. The results of this analysis are presented in Table 16.

Table 16

The Relationship Between
Intended Use of Computers – Personal
by Computer Attitudes

Predictor Variable	Constant	b Weight	Beta	r^2	t-Value	p Value
Intended Use – Personal Computer Liking	-.30	.20	.47	.22	5.48	<.001
Intended Use – Classroom Instruction Computer Liking	2.98	.11	.29	.08	3.06	.003
Intended Use – Classroom Management Computer Usefulness	-.97	.20	.35	.13	3.90	<.001

One independent variable, computer liking, entered the stepwise multiple linear regression analysis, explaining 22% of the variation in intended personal use of computers. Teachers who had higher scores on intended personal use of computers were more likely to have higher scores on the computer liking.

The independent variable, computer liking, entered the stepwise multiple linear regression analysis, explaining 8% of the variation in intended use of computers in classroom instruction. Based on this finding, it appears that teachers who have higher scores on computer liking are more likely to intend to use computers in classroom instruction.

One independent variable, scores on computer usefulness, entered the stepwise multiple linear regression equation, explaining 13% of the variance in intended use of computers in the classroom.

Intended use of computers for personal and classroom instruction was associated with scores on computer liking. If teachers liked computers, they were more likely to use computers in their personal lives and for teaching. If they thought computers were useful, they were more likely to use them for classroom management.

Research question 11. What is the relationship between teachers' self-efficacy and their intended use of computers?

The intended personal use of computers, intended use of computers for classroom instruction, and intended use of classroom management were used as the dependent variables in separate stepwise multiple linear regression analyses, with scores on general and social self-efficacy used as the independent variables. None of the independent variables entered the regression equations, indicating they were not significant predictors of intended use of computers for personal uses, classroom instruction, and classroom management.

Research question 12. What is the relationship between teachers' extent of innovativeness and their intended use of computers?

Teachers' scores on innovativeness were used as the independent variables in a stepwise multiple linear regression analysis, with intended personal use of computers, intended use of computers for classroom instruction, and intended use of computers for classroom management used as dependent variables in separate stepwise multiple linear regression analyses. The results of these analyses are presented in Table 17.

Table 17

Stepwise Multiple Linear Regression Analysis
The Relationship Between Intended Use of Computers by Innovativeness (N=108)

Intended Use of Computers	Constant	b Weight	Beta	r^2	t-Value	p Value
Personal Innovativeness	2.18	.03	.22	.05	5.33	.023
Classroom Instruction None Entered						
Classroom Management None Entered						

Innovativeness entered the stepwise multiple linear regression analysis, explaining 5% of the variance in intended use of computers for personal use. The positive relationship between intended use of computers for personal use and innovativeness indicated that teachers who intended to use computers for personal use tended to have higher scores on innovativeness.

Innovativeness did not enter the regression equation, indicating it was not a significant predictor of intended use of computers for classroom instruction. Scores on innovativeness did not enter the regression equation, indicating it was not a statistically significant predictor of intended use of computers for classroom management.

Based on these findings, innovativeness does not appear to be a significant predictor of intended use of computers in the classroom, although teachers who were innovative were more likely to use them for personal matters.

Intended Use of Computers by Personal and Professional Characteristics and Previous Experience with Computers

> *Research question* 13. What is the relationship between teachers' personal characteristics and their intended use of computers?

The intended use of computers for personal use, classroom instruction, and classroom management was used as the dependent variable in a stepwise multiple linear regression. The independent variables in this analysis were the personal characteristics of the participants, including age, gender, marital status, and number of children. The findings from this analysis showed that none of the independent variables entered the equation, indicating they were not significant predictors of teachers' intended personal use of computers. When intended use of computers for classroom instruction was used as the dependent variable in a stepwise multiple linear regression analyses with the same independent variables, none of the independent variables entered the regression equation, indicating they were not significant predictors of teachers' intended use of computers for classroom instruction.

Intended use of computers for classroom management was used as the dependent variable, with the same independent variables used in a stepwise multiple linear regression analysis. The results of this analysis are presented in Table 18.

Table 18

The Relationship Between
Intended Use of Computers by Personal Characteristics (N=108)

Predictor Variable	Constant	b Weight	Beta	r^2	t-Value	p-Value
Personal Use						
None Entered						
Classroom Instruction						
None Entered						
Classroom Management						
Age of Respondent	7.49	-.87	-.32	.10	-3.51	.001

Age of the respondent entered the stepwise multiple linear regression analysis, explaining 10% of the variance in intended use of computers for classroom management. The negative relationship between age and intended use of computers indicated that younger teachers were more likely to intend to use computers for classroom management.

Research question 14. What is the relationship between teachers' professional characteristics and their intended use of computers?

Teachers' professional characteristics; including educational level, building level, years in education, and years in current position; were used as the independent variables in a stepwise multiple regression equation. Intended use of computers for personal use, classroom instruction, and classroom managements were used as the dependent variables. Table 19 presents the results of this analysis.

Table 19

The Relationship Between
Intended Use of Computers
by Professional Characteristics (N=108)

Predictor Variable	Constant	b Weight	Beta	r^2	t-Value	p-Value
Personal Use						
Number of years in education	6.39	-.04	-.20	.04	-2.12	.036
Classroom Instruction						
Teaching at Middle School Level	7.11	-1.55	-.33	.08	-3.53	.001
Teaching at High School Level		-.96	-.21	.04	-2.25	.027
Classroom Management						
Number of years in education	6.38	-.07	-.26	.07	-2.80	.006

One independent variable, number of years in education, entered the stepwise multiple linear regression analysis, explaining 4% of the variance in intended use of computers for personal use. The negative relationship between intended use of computers for personal use and years in education indicated that teachers who had been in education for fewer years had greater intentions of using computers for personal use.

Two independent variables, teaching at the middle school level and teaching at the high school level, entered the stepwise multiple linear regression analysis accounting for 12% of the variance in intended use of computers for classroom instruction. Teaching at the middle school level explained 8% of the variance in intended use of computers for classroom instruction. The negative relationship between teaching at the middle school level and intended use of computers for classroom instruction indicated that teachers who were not at the middle school level were more likely to use computers for classroom instruction. Four percent of the variance in intended use of computers for classroom instruction was explained by teaching at the high school level. The negative relationship between teaching at the high school level and intended use of computers for classroom instruction indicated that teachers who were not at the high school level tended to use

computers for classroom instruction.

Number of years in education entered the stepwise multiple linear regression equation, explaining 7% of the variance in intended use of computers for classroom management. The negative value of this relationship indicated that teachers with less experience in education were more likely to intend to use computers for classroom management.

Research question 15. What is the relationship between teachers' previous computer experiences and their intended use of computers?

The intended use of computers for personal use, classroom instruction, and classroom management were used as dependent variables in separate stepwise multiple linear regression analyses. The independent variables in these analyses included use of computers at home, in the classroom, and in other places, years of computer experience, and self-reported computer skills. The results of this analysis are presented in Table 20.

Table 20

The Relationship Between
Intended Use of Computers – Personal Use
by Previous Computer Experiences (N=108)

Predictor Variable	Constant	b Weight	Beta	r^2	t-Value	p-Value
Personal Use						
Self-Reported Computer Skill [@]	6.03	-.42	-.22	.06	-2.32	.023
Access to Computers at Home		1.03	.22	.05	2.30	.023
Classroom Instruction						
Access to Computers in Classroom	5.02	1.70	.33	.11	3.56	.001
Classroom Management						
Self-reported Computer Skill [@]	6.37	-.46	-.20	.04	-2.08	.040

[@]Lower scores reflect higher self-reported computer skills

Two independent variables, self-reported computer skills and access to computer at home, entered the stepwise multiple linear regression equation, explaining 11% of the

variance in intended personal use of computers. Self-reported computer skills entered the stepwise multiple linear regression equation, explaining 6% of the variance in intended personal use of computers. The negative relationship between the two variables showed that teachers who self-reported their computer skills higher were more likely to intend to use computers for personal use. The access to computers at home entered the stepwise multiple linear regression analysis, explaining an additional 5% of the variance in intended personal use of computers. Based on this finding, teachers who had computers at home were more likely to intend to use computers for personal use.

Access to computers in the classroom explained 11% of the variance in intended use of computers for classroom instruction. The F ratio of 12.69 was statistically significant at an alpha level of .05 with 1 and 106 degrees of freedom. Based on these findings, teachers with computers in their classroom were more likely to use computers for instruction.

Self-reported computer skill entered the regression equation, explaining 4% of the variance in intended use of computers for classroom management. This result indicated that teachers who perceived their computer skills were better intended to use computers for classroom management.

Intended Use of Computers and Teachers' Computer Attitudes, Level of Self-efficacy, and Innovativeness

> *Research question 16*: What is the relationship between teachers' computer attitudes, level of self-efficacy, and innovativeness and intended use of computers?

The four measures of computer attitudes; computer anxiety, computer confidence, computer liking, and computer usefulness, general and social self-efficacy, and perceptions of innovation were used as independent variables in a stepwise multiple linear regression analysis. The intended use of computers for personal use was used as the

dependent variable in this analysis. The results of this analyses are presented in Table 21.

Table 21

The Relationship Between
Intended Use of Computers – Personal Use
by Computer Attitudes, Self-efficacy, and Innovativeness (N=108)

Predictor Variable	Constant	b Weight	Beta	r^2	t-Value	p Value
Personal Use Computer Liking	-.30	.20	.47	.22	5.48	<.001
Classroom Instruction Computer Liking	2.98	.11	.29	.08	3.06	.003
Classroom Management Computer Usefulness	-.97	.20	.35	.13	3.90	<.001

One variable, computer liking, entered the multiple linear regression analysis, explaining 22% of the variance in intended use of computers for personal use. This finding indicated that the amount of variance in intended use of computers for personal use was significant.

Eight percent of the variance in the intended use of computers in classroom instruction was explained by computer liking. This result indicated that teachers who liked computers were more likely to use computers for classroom use.

Thirteen percent of the variance in intended use for classroom management was explained by computer usefulness. The positive direction of the relationship showed that teachers who perceived that computers were useful were more likely to use them for classroom management.

Intended Use of Computers and Teachers' Personal Characteristics, Professional Characteristics, Previous Computer Experience, Computer Attitudes, Self Efficacy, and Innovativeness

> *Research question 17.* What is the relationship between the intended use of computers and teachers' personal characteristics, professional characteristics, previous computer experience, computer attitudes, self

efficacy, and innovativeness?

The intended use of computers for personal use, classroom instruction, and classroom management were used as dependent variables in separate stepwise multiple linear regression analyses. The same set of independent variables were entered in groups in each analysis. These groups of variables included:

- personal characteristics (gender, age, marital status, and number of dependent children);
- professional characteristics (educational level, teaching at the elementary, middle, and high school levels, years in education, and years in current position);
- previous computer experiences (access to computers at home, in the classroom, and in other places, and self-reported computer skill);
- computer attitudes (anxiety, confidence, liking, and usefulness)
- general and social self-efficacy; and
- innovativeness.

The results of this analysis are presented in Table 22.

Table 22

The Relationship Between Intended Use of Computers – Personal Use by Personal and Professional Characteristics, Previous Computer Experience, Computer Anxiety, Self-Efficacy, and Innovativeness (N=108)

Predictor Variable	Constant	b Weight	Beta	r^2	t-Value	p Value
Personal Use						
Number of years in education	.29	-.03	-.14	.04	-1.67	.097
Access to computers at home		.74	.16	.05	1.81	.073
Computer Liking		.18	.43	.18	5.02	<.001
Classroom Instruction						
Middle School	3.19	-1.50	-.32	.08	-3.59	.001
High School		-.89	-.20	.04	-2.14	.035
Access to Computer in Classroom		1.15	.22	.08	2.42	.017
Computer Usefulness		.10	.22	.04	2.43	.017
Classroom Management						
Age of Respondent	2.71	-.81	-.30	.10	-3.43	.001
Computer Liking		.16	.31	.10	3.54	.001

Three independent variables; number of years in education (r^2=.04), access to computers at home (r^2=.05), and computer liking (r^2=.18); entered the stepwise multiple linear regression equation, explaining a total of 27% of the variance in intended personal use of computers. Number of years in education was negatively related to intended personal use of computers, indicating that teachers with less years in education were more likely to intend to use personal computers. Teachers who had access to computers in their homes and those who had higher scores on computer liking were more likely to indicate they intended to use computers for personal use.

Twenty-four percent of the intended use of computers for classroom instruction was explained by four variables; teaching at the high school level (r^2=.08), teaching at the middle school level (r^2=.04), access to computers in classrooms (r^2=.08), and perceptions of computer usefulness (r^2=.04); entered the stepwise multiple linear regression analysis. Teachers who were not teaching middle or high school were more likely to use computers in the classroom for instruction. Teachers who had access to computers in the classroom

and had high scores on computer liking indicated that they intended to use computers for classroom instruction.

Two independent variables, age of respondent (r^2=.10) and perceptions of computer liking (r^2=10), entered the stepwise multiple linear regression analysis, explaining a total of 20% of the variance in intended use of computers for classroom management. The findings on this analysis indicated that teachers who were younger and had higher scores on computer liking were more apt to intend that they were going to use computers for classroom management.

Summary

A total of 108 teachers from one semi-rural school district participated in this study. They provided information on their personal and professional characteristics, as well as data on their previous experiences with computers. The teachers' attitudes toward computers, their perceived levels of innovativeness, and their self-efficacy were examined in this study. The intended use of computers for personal use, classroom instruction, and classroom management. A summary of the results of the regression analyses used to answer the research questions are presented in Table 23.

Table 23

Summary of the Results of Regression Analyses

Research Question	Dependent Variable	Significant Independent Variables
1. What is the relationship between personal characteristics of teachers and their attitudes toward computers?	Computer anxiety	None entered
	Computer confidence	Age of teacher (-)
	Computer liking	None entered
	Computer usefulness	Age of teacher (-)
2. What is the relationship between personal characteristics of teachers and their level of self-efficacy?	General self-efficacy	None entered
	Social self-efficacy	None entered
3. What is the relationship between personal characteristics of teachers and their extent of innovativeness?	Extent of innovativeness	None entered
4. What is the relationship between professional characteristics of teachers and their attitudes toward computers?	Computer anxiety	None entered
	Computer confidence	Number of years in education (-)
	Computer liking	None entered
	Computer usefulness	Number of years of education (-) Level of education (+)
5. What is the relationship between professional characteristics of teachers and their level of self-efficacy?	General self-efficacy	None entered
	Social self-efficacy	None entered
6. What is the relationship between professional characteristics of teachers and their extent of innovativeness?	Extent of innovativeness	None entered
7. What is the relationship between teachers' previous computer experience and their attitudes toward computer?	Computer anxiety	Years using a computer (+) Self-reported computer skill [@] (-)
	Computer confidence	Self-reported computer skill [@] (-) Years using a computer (+)
	Computer liking	Self-reported computer skill [@] (-) Years using a computer (+)
	Computer usefulness	Years using a computer (+) Self-reported computer skill [@] (-)
8. What is the relationship between teachers' previous computer experience and their level of self-efficacy?	General self-efficacy	Self-reported computer skill [@] (-)
	Social self-efficacy	None entered
9. What is the relationship between teachers' previous computer experience and their extent of innovativeness?	Extent of innovation	Years using a computer (+)

Table Continues

Research Question	Dependent Variable	Significant Independent Variables
10. What is the relationship between teachers' computer attitudes and their intended use of computers?	Intended use – personal	Computer liking (+)
	Intended use – classroom instruction	Computer liking (+)
	Intended use – classroom management	Computer usefulness (+)
11. What is the relationship between teachers' self-efficacy and their intended use of computers?	Intended use – personal	None entered
	Intended use – classroom instruction	None entered
	Intended use – classroom management	None entered
12. What is the relationship between teachers' extent of innovativeness and their intended use of computers?	Intended use – personal	Extent of innovativeness (+)
	Intended use – classroom instruction	None entered
	Intended use – classroom management	None entered
13. What is the relationship between teachers' personal characteristics and their intended use of computers?	Intended use – personal	None entered
	Intended use – classroom instruction	None entered
	Intended use – classroom management	Age of respondent (-)
14. What is the relationship between teachers' professional characteristics and their intended use of computers ?	Intended use – personal	Number of years in education (-)
	Intended use – classroom instruction	Teaching at middle school level (-) Teaching at high school level (-)
	Intended use – classroom management	Number of years in education (-)
15. What is the relationship between teachers' previous computer experiences and their intended use of computers?	Intended use – personal	Self-reported computer skill @ (-) Access to computers at home (+)
	Intended use – classroom instruction	Access to computers in classroom (+)
	Intended use – classroom management	Self-reported computer skill @ (-)
16. What is the relationship between teachers' computer attitudes, level of self-efficacy, and innovativeness and their intended use of computers?	Intended use – personal	Computer liking (+)
	Intended use – classroom instruction	Computer liking (+)
	Intended use – classroom management	Computer usefulness (+)

Table continues

Research Question	Dependent Variable	Significant Independent Variables
17. What is the relationship between the intended use of computers and teachers' personal characteristics, professional characteristics, previous computer experience, computer attitudes, self efficacy, and innovativeness?	Intended use – personal	Number of years in education (-) Access to computers at home (+) Computer liking (+)
	Intended use – classroom instruction	Middle School (-) High School (-) Access to computer in classroom (+) Computer usefulness (+)
	Intended use – classroom management	Age of respondent (-) Computer liking (+)

The conclusions and recommendations for instructional technology based on these findings can be found in Chapter V.

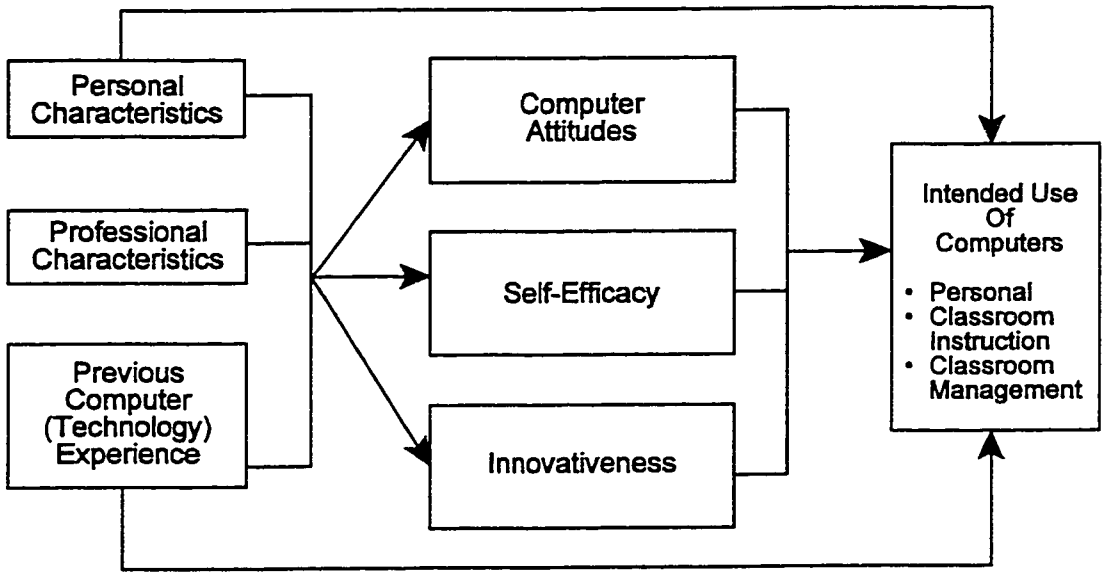
Chapter V

Discussion, Conclusions, and Recommendations

The conceptual model that underlies this study is based upon the literature. It examines the domains of learner personal and professional characteristics, computer attitudes, self efficacy, and innovativeness as they relate to intended use of computers for personal use, classroom instruction, and classroom management. The model connects the relevant variables in this study first by suggesting that profile characteristics and previous computer experience directly affect computer attitudes, as well participants' degree of self efficacy and extent of innovativeness. The model proposes that relationships may also exist among profile characteristics, previous computer experience, and the intended use of computers on the part of the instructional staff. This conceptual model is outlined in Figure 4 below.

Figure 4

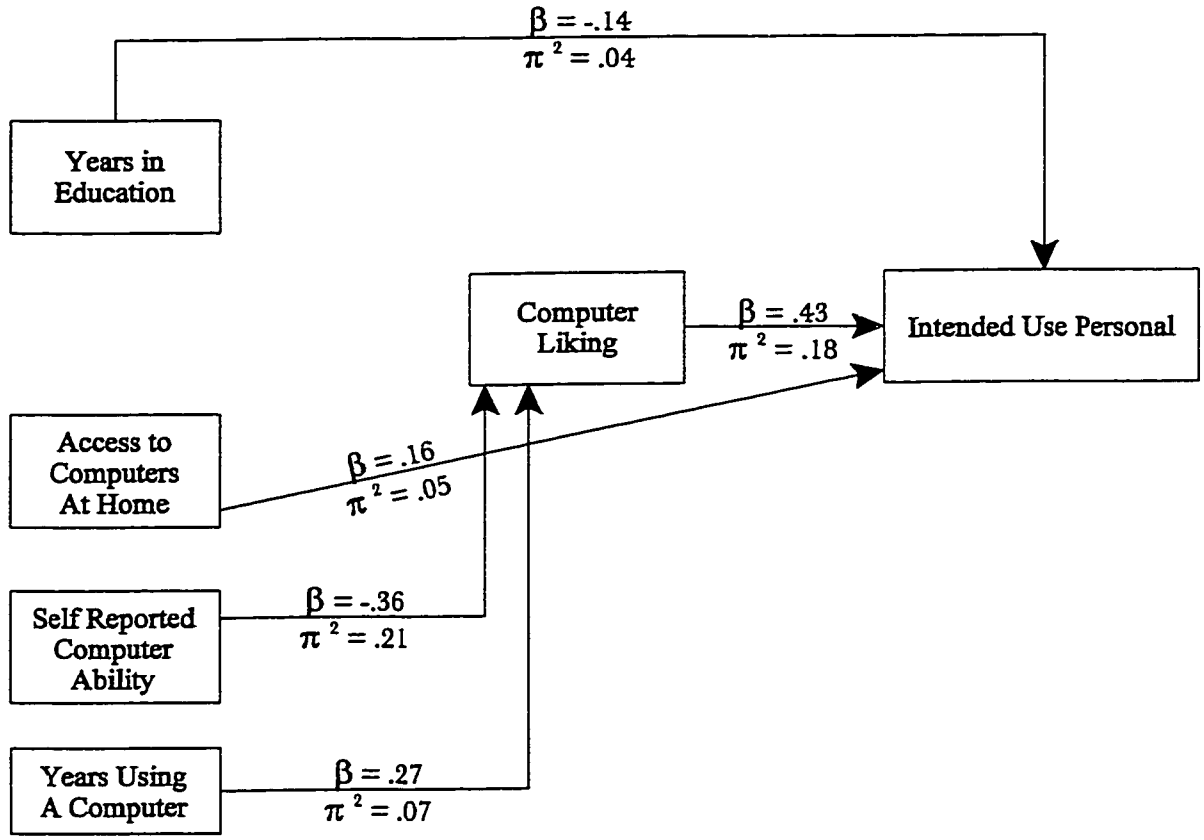
Conceptual Model



After testing the conceptual model, three new models were developed as replacements. The first of these models represents teachers' intended personal use of computers and is depicted in Figure 5 below.

Figure 5

Teachers' Intended Personal Use of Computers



The number of years in education was found to have a direct negative effect on the intended personal use of computers. From this finding, it appears that teachers with fewer years in education may be expected to utilize computers for personal use. Teachers with fewer years in education were found to plan to use computers for personal activities. These teachers were generally younger and may have had experience with computers

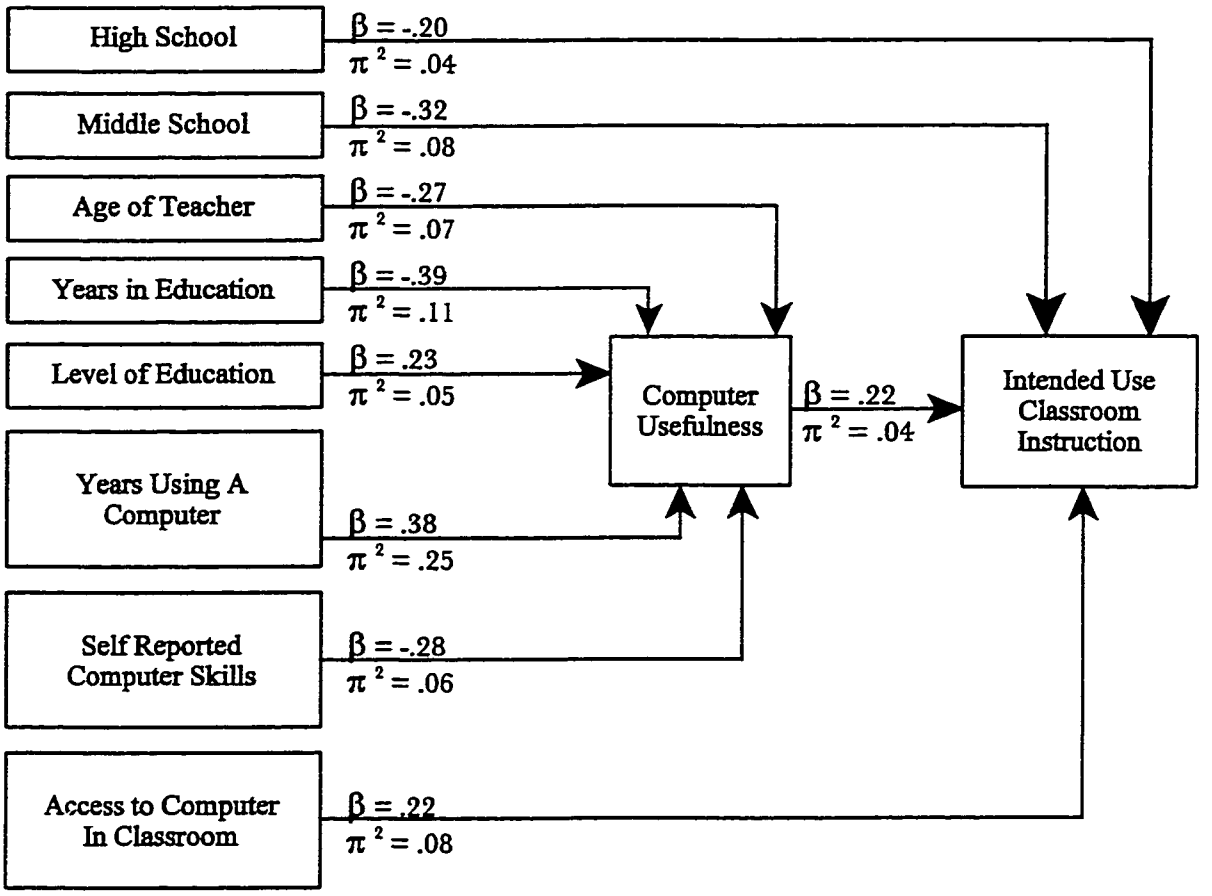
beginning in their K-12 education, while teachers who were older and had greater years in education may have been resistant to learning to use computers beyond what was necessary for them to function in their classrooms.

Greater self-reported computer ability was found to be an indirect predictor of teacher use of computers for personal activities, with greater computer ability directly predicting computer liking, which had a direct effect on the intended use of computers for personal endeavors. Access to a computer at home was also found to be a predictor of teacher use of computers for personal projects. This may be an example of a reciprocal relationship where greater use and access to computers enhance computer expertise.

The second model developed as a result of this study relates to teachers' intended use of computers for classroom instruction and is illustrated in Figure 6 below.

Figure 6

Teachers' Intended Use of Computers for Classroom Instruction



The age of the teacher and number of years in education may be measures of similar constructs; younger teachers may be expected to have fewer years in education. The effect of the age of the teacher and the level of educational attainment may also be associated; younger teachers and teachers with higher levels of educational attainment may have been enrolled in courses more recently than older teachers and those with lower levels of educational attainment. Each of these variables was found to be related to perceptions of computers usefulness, with younger, less experienced teachers and those

with a higher level of education demonstrating a greater appreciation of computer usefulness, and subsequently a greater likelihood of intending to use computers for classroom instruction. It may be that teachers with these characteristics had recently completed their teacher education programs that included using computers for classroom instruction. They may have been more receptive to district directives regarding the use of technology in classrooms than teachers with more experience and further removed from their teaching methods classes.

The number of years using a computer, as well as high level of self reported computer ability, were found to predict an appreciation of computer usefulness, and resultant potentiality for using computers for classroom instruction. These experiences can promote competence and confidence in using computers in the classroom and influence teachers to incorporate computers into classroom instruction.

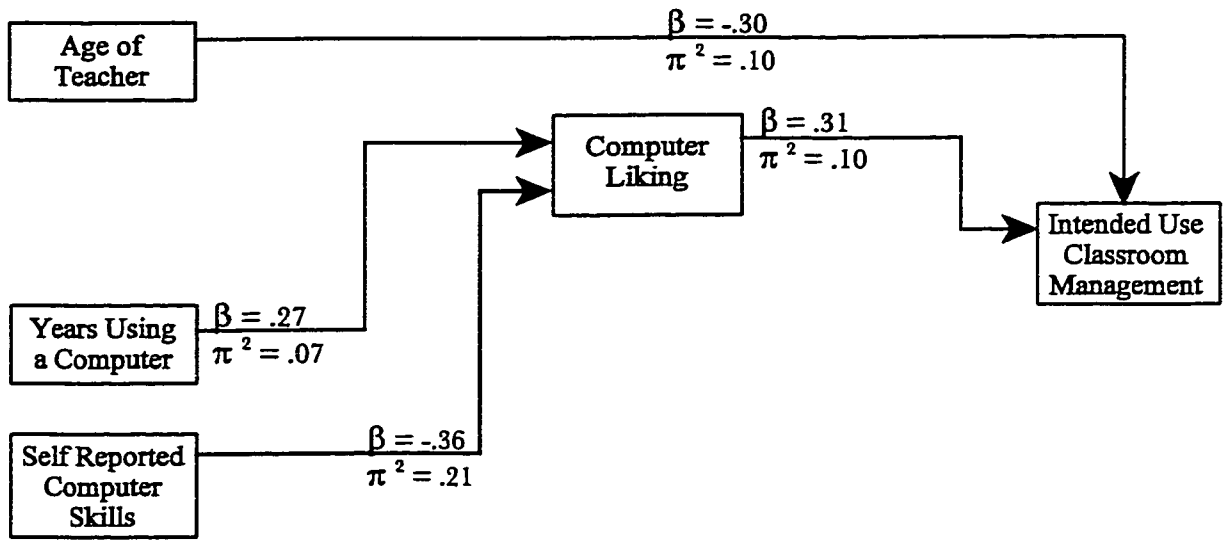
Access to computers in the classroom was found to be directly and positively related to teachers' intended use of computers for classroom instruction. High school and middle school teachers were less likely to intend to use computers for classroom instruction. Elementary school teachers were found to indicate an intention to use computers for classroom instruction. Elementary school teachers are more likely to have at least one computer located in their classroom with many educational programs available for students at this level. In many schools, elementary classrooms are networked with programs providing progressive instruction that allow students to move freely, based on their ability. Teachers in elementary schools often use the computer as a reward system for behavioral and cognitive gains. As a result, elementary school teachers are more likely to intend to use computers for classroom instruction. Middle and high school teachers generally have to seek computers in either lab settings or in the media center

which can restrict their usage for classroom instruction. Although teachers at this level may not use computers directly, some assignments may require the student to use the internet or CD-ROMs for research.

The third model developed as a result of this study relates to teachers' intended use of computers for classroom management and is illustrated in Figure 7 below.

Figure 7

Teachers' Intended Use of Computers for Classroom Management



The age of the respondent was found to directly effect intended use of computers for classroom management. This characteristic was negatively related, with younger teachers more inclined to intend to use computers for classroom management.

Years using a computer and self reported computer expertise had a direct effect on computer liking and an indirect effect on intended use of computers for classroom management. Teachers with more experience using computers and teachers with greater self reported computer expertise tended to like computers and appeared to be more willing to use computers for classroom management, performing such functions as grade

computation, attendance, lesson plans, classroom seating charts, and correspondence with parents.

Teachers who use computers for classroom management had to be willing to learn new software and develop innovative uses for the computer on their own. Classroom management includes the record keeping functions that teachers have generally compiled by hand over the years. Younger teachers with few years in education have not developed these habits and tend to be more open to using the computer as a tool to lighten their paperwork and provide more time for developing instructional strategies for their students.

Discussion

As younger teachers enter the profession, it appears that computer anxiety, or technophobia, will no longer be a barrier to the use of computers by teachers for personal activities, classroom instruction, and classroom management. The teachers in this study exhibited high degrees of self efficacy and innovativeness, but these variable were not found to be significant predictors of teacher use of computers. Self efficacy and innovativeness were global measures that may not have been specific enough to determine if teachers were efficacious in the use of computers. Innovativeness in this school district was encouraged by administration, with expectations that teachers would become risk takers in trying innovative instructional strategies with their students.

Other variables that were not measured, such as participation in professional development, personal development, and teachers' current educational status may have influenced the results of this study. Teachers who engage in these activities may become more reflective practitioners, enabling them to develop as change agents.

Implications for Instructional Technology

Attitudes may be cognitive (ideas), affective (feelings), or behavioral (actions). Generally, attitudinal considerations are included in the affective domain of the learner's skills. Richey (1986) considers affective components as learning tasks, as well as a type of learner characteristic. As such, a designer "could incorporate instructional activities in a program which led directly to the examination, or modification, or a learner's values, beliefs, attitudes, or emotional responses" (p. 150). Instructional design might be developed to address the specific needs of these learners in order to modify attitudes.

The design of professional development activities for teachers within this target audience should be based on research findings related to adult learning theory. It may be that veteran teachers at the middle and high school level have a need to appreciate the immediate application and benefits of using a computer for personal activities, classroom instruction and classroom management.

Since adults are more inclined to be self directed, as well as problem centered learners, instruction may be designed which employs the use of study groups and action research as professional development activities. Study groups would enable adult learners to share experiences, a rich resource for adult learning and action research would allow these learners to become active, autonomous, and reflective practitioners. Each of these activities can empower the teacher and provide for more options in the workplace and the academic setting. Providing individuals with appropriate training, course work, hands on and successful experiences with computers under non threatening conditions may increase their inclination to appreciate and utilize computers for personal use, classroom instruction, and classroom management.

Recommendations for Further Research

Other variables, such as participation in professional development, personal development, and teachers' current educational status may be topics for additional research. An investigation of the correlation between teacher use of computers and student achievement, as well as the relationship between subject area and teacher use of technology, are additional topics which may be of interest to researchers.

The results of this study indicate that the subscales of computer anxiety and computer confidence do not appear to be significant predictors of the intended use of computers. These portions of the instrument may no longer be meaningful predictors of intended use of computers. A similar investigation might be conducted, using an instrument which measures teachers' enjoyment of computer use and perceptions of the relevance of technology as predictors of their intended use of computers for personal use, classroom instruction, and classroom management.

APPENDIX A

— Correspondence —

Gail Northcutt

Dr. Peter A. Lichtenberg, Chairman
Behavioral Investigation Committee
Wayne State University
Detroit, MI 48202

Dear Dr. Lichtenberg:

I am submitting the attached forms for review by the Behavioral Investigation Committee (BIC). I feel that my study is exempt from review by the committee as it meets the criteria described in Exemption Category 2.

Schools are allocating funds for the integration of technology, specifically computer technology, and the equipment is often not fully utilized. There is a need to examine the attitudes of teachers toward technology and how those attitudes affect the integration of technology into curriculum development, supervision of instruction, lesson planning, and the delivery of instruction. Those attitudes may be related to personal and professional characteristics of teachers, their previous computer experience, as well as their level of self efficacy and their extent of willingness to adopt innovation. If the predictors of teacher use of technology can be identified, then professional development activities may be designed to address the appropriate domains.

A copy of the cover letter and instruments are enclosed with my approved proposal for your review. The cover letter includes the items that are needed in an informed consent form. If you have any suggestions or feel this letter needs to be revised, please contact me at your earliest convenience. I will make the necessary changes that you may require.

Sincerely,

Gail Northcutt

Gail Northcutt

Enclosures

Wayne State University
Human Investigation Committee

Behavioral Institutional Review Board
University Health Center 8C
4201 St. Antoine Blvd.
Detroit, MI 48201
(313) 577-5174 Office
(313) 993-7122 Fax

MEMORANDUM

TO: Gail Northcutt

FROM: Peter A. Lichtenberg, Ph.D. Peter A. Lichtenberg, PhD
Chairman, Behavioral Institutional Review Board

SUBJECT: Exemption Status of Protocol # B03-06-97(B03)-X; "The Predictors of Teacher Use of Technology"

SOURCE OF FUNDING: No Funding Requested

DATE: April 1, 1997

==========

The research protocol named above has been reviewed and found to qualify for exemption according to paragraph #2 of the Rules and Regulations of the Department of Health and Human Services, CFR Part 46.101(b).

Since I have not evaluated this proposal for scientific merit except to weigh the risk to the human subjects in relation to potential benefits, this approval does not replace or serve in the place of any departmental or other approvals which may be required.

C: Dr. Rita C. Richey
381 Education

B030697.X
(B03 APPROVALS)

Gail Northcutt

February 26, 1997

Mr. James Orwin
Superintendent
Airport Community Schools
11270 Grafton Road
Carleton, Michigan 48009

Dear Mr. Orwin:

I would like to take this time to thank you for your interest and assistance in my study on "The Predictors of Teacher Use of Technology." Before I can progress with this study, I need a commitment letter from you on your school letterhead that you will allow me to conduct this study in April, 1997 per our conversation.

The use of technology in schools is an important component in academic achievement of our student population. As we approach the 21st century, staff and students alike must be technologically empowered in order to prepare youngsters to successfully compete in the global job market and to enjoy an enhanced quality of life.

I am enclosing the instruments that will be used in this study: CAS, SES, IS, and a short demographic survey. These instruments should not take more than 30 minutes to complete. If you have any questions or concerns regarding these instruments, I will be more than happy to review them with you or your teachers.

Participation in this study is voluntary and all data obtained from the surveys will be confidential. The results of the findings will be presented in summarized form with no individual participant identifiable from the findings.

As part of the development of the research proposal for a dissertation, I need to obtain a confirmation in writing of your school district's willingness to allow me to conduct the research in the Airport Community School District to present to the Behavioral Investigation Committee (BIC) at Wayne State University. Your commitment letter needs to be provided on school district letterhead. If you have any questions regarding this research, you may contact me at or Dr. Rita Richey at (313) 577-1738. If you have any questions regarding the BIC requirements, you may call Dr. Peter Lichtenberg at (313) 577-5174.

Thank you in advance for your consideration in this matter.

Sincerely,

Gail Northcutt

Gail Northcutt

Enclosures

AIRPORT COMMUNITY SCHOOLS

11270 Grafton Road Carleton, Michigan 48117

SUPERINTENDENT
(313) 654-2414

BUSINESS OFFICE
(313) 654-3420
Fax (313) 654-3424

CURRICULUM / STATE & FEDERAL PROGRAMS
(313) 654-3000
Fax (313) 654-3001

ADULT / COMMUNITY EDUCATION
(313) 654-8320

SPECIAL EDUCATION
(313) 654-3427

ATHLETIC DEPARTMENT
(313) 654-8208

AIRPORT HIGH SCHOOL
(313) 654-8208
Fax (313) 654-8730

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(313) 654-8205
Fax (313) 654-0057

EYLER ELEMENTARY
(313) 654-2121
Fax (313) 654-9535

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(313) 586-2678
Fax (313) 586-3342

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(313) 379-5335
Fax (313) 379-0701

STERLING ELEMENTARY
(313) 654-6846
Fax (313) 654-9480

SUPERVISOR OF FACILITIES
(313) 654-8181

TRANSPORTATION
(313) 654-3433
Fax (313) 654-3005

February 28, 1997

Ms. Gail Northcutt

Dear Ms. Northcutt:

As requested in your letter of February 26, 1997 please be advised that I am granting your request allowing you to conduct a survey in the Airport Community School District to present to the Behavioral Investigation Committee (BIC) at Wayne State University.

If additional information is needed, please do not hesitate to contact me.

Sincerely,

James Orwin
Superintendent

JO:pd

Gail A. Northcutt

To: Teachers in the Airport Community School District

I am a doctoral student in instructional technology at Wayne State University. I am working on my dissertation, The Predictors of Teachers' Use of Technology. This study is intended to determine if there are personal or professional characteristics, previous computer/technology experiences, computer attitudes, level of self-efficacy, and degree of innovativeness that can be used to predict the intended use of computers for personal and classroom use.

The instruments that are included in this study are the Computer Attitude Scale, Self-Efficacy Scale, Innovativeness Scale, Profile Characteristics, and Computer Use/Current and Intended. These instruments should take no longer than 20 minutes to complete.

Please be advised that all responses will be confidential and that no individual will be identifiable from the analysis that will be provided on the final report. The surveys are coded, but the purpose of this coding is to allow the researcher to maintain control over outstanding surveys during data collection. The code book with the names of the participants will be destroyed after all data collection has been completed. No risks or additional effects are likely to result from your participation in this study. In the unlikely event of an injury arising from participation in this study, no reimbursement, compensation, or free medical treatment is offered by Wayne State University or the researcher.

The Superintendent of Airport Community Schools, Mr. James Orwin, has agreed to allow me to conduct this survey and your participation is voluntary. The return of your completed survey is evidence of your willingness to participate.

Please return the completed survey packet within one week in the enclosed self-addressed, stamped envelope and return it to the researcher by United States mail. If you have any questions regarding the items on the survey or the purpose of the study, please feel free to contact me at This number is to my home where I have an answering machine. I will return your call within 24 hours. If you would like information regarding your rights regarding participation in this study, please contact Dr. Peter Lichtenberg, Wayne State University Behavioral Investigation Committee at (313) 577-1628.

Enclosed is a token of my appreciation for your participation in this study. An additional memento will be sent to you when I have received your completed survey. Thank you.

Sincerely,

Gail A. Northcutt

Gail A. Northcutt
Doctoral Candidate

Enclosures

Curry School of Education, University of Virginia
405 Emmet Street, S., Charlottesville, VA 22903-2495

Department of Leadership, Foundations, and Policy

October 20, 1998

Gail Northcutt

Dear Ms. Northcutt:

In response to your inquiry, I am enclosing a copy of our survey of attitudes towards computers.

The survey is scored according to the following:

- **For questions** 1, 3, 4, 6, 9, 11, 12, 14, 16, 17, 19, 22, 25, 27, 28, 30, 33, 35, 36, 38 (Strongly Agree=4, Slightly Agree=3, Slightly Disagree=2, Strongly Disagree=1).
- **For questions** 2, 5, 7, 8, 10, 13, 15, 18, 20, 21, 23, 24, 26, 29, 31, 32, 34, 37, 39, 40 (Strongly Agree=1, Slightly Agree=2, Slightly Disagree=3, Strongly Disagree=4).

The questions are coded so that the higher the score, the more positive the attitude.

Four subscores can also be obtained from the questions.

- Anxiety: 1, 5, 9, 13, 17, 21, 25, 29, 33, 37
- Confidence: 2, 6, 10, 14, 18, 22, 26, 30, 34, 38
- Liking: 3, 7, 11, 15, 19, 23, 27, 31, 35, 39
- Usefulness: 4, 8, 12, 16, 20, 24, 28, 32, 36, 40

Again, higher scores correspond to more positive attitude, e.g., a higher confidence score means more confidence and a higher anxiety score means *less* anxiety.

Permission is granted for use of this scale.

Sincerely,

Sandra L. Davis
Assistant to Dr. Loyd

Enclosure

Administration and Supervision • Higher Education • Policy Studies (804) 924-3160
Educational Psychology–Gifted • Instructional Technology • Social Foundations (804) 924-7471
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FAX (804) 924-0747 or 924-3866
(804) 982-4327 V/TDD

MISSISSIPPI METHODIST
REHABILITATION CENTER

1350 East Woodrow Wilson
Jackson, Mississippi 39216
Telephone 601 981-2611
1-800-223-6672
www.mmrcrehab.org

July 27, 1998

Gail Northcutt

Dear Ms. Northcutt:

This letter is in response to your request for permission to use the Self-efficacy Scale. Please find attached two copies of the scale. One copy is marked with scoring instructions. You may reproduce the scale for use in your research.

I have also enclosed a partial list of articles that have cited the scale. This is not an updated list. However, you may find other articles by consulting the *Social Sciences Citation Index* at your library. I hope these materials are helpful to you. Good luck with your research.

Sincerely,

Mark Sherer, Ph.D., ABPP/CN
Director of Neuropsychology

MS/rg

Enclosures

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Ms. Gail Northcutt

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July 24, 1998
Date

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Signature of Requester

Date:

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APPENDIX B

— Instrument —

SURVEY OF ATTITUDES TOWARD LEARNING ABOUT AND WORKING WITH COMPUTERS

SECTION I: Computer Attitude Scale

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

Below are a series of statements. There are no correct answers to these statements. They are designed for you to indicate if you agree or disagree with the ideas expressed. Place a (✓) checkmark in the appropriate boxes.	SD 1	D 2	A 3	SA 4
1. Computers do not scare me at all.				
2. I'm no good with computers.				
3. I would like working with computers.				
4. I will use computers many ways in my life.				
5. Working with a computer would make me very nervous.				
6. Generally I would feel OK about trying a new problem on the computer.				
7. The challenge of solving problems with computers does not appeal to me.				
8. Learning about computers is a waste of time.				
9. I do not feel threatened when others talk about computers.				
10. I don't think I would do advanced computer work.				
11. I think working with computers would be enjoyable and stimulating.				
12. Learning about computers is worthwhile.				
13. I feel aggressive and hostile toward computers.				
14. I am sure I could do work with computers.				
15. Figuring out computer problems does not appeal to me.				
16. I'll need a firm mastery of computers for my future work.				
17. It wouldn't bother me at all to take computer courses.				
18. I'm not the type to do well with computers.				
19. When there is a problem with a computer run that I can't immediately solve, I would stick with it until I have the answer.				
20. I expect to have little use for computers in my daily life.				
21. Computers make me feel uncomfortable.				
22. I am sure I could learn a computer language.				
23. I don't understand how some people can spend so much time working with computers and seem to enjoy it.				
24. I can't think of any way that I will use computers in my career.				
25. I would feel at ease in a computer class.				
26. I think using a computer would be very hard for me.				

Below are a series of statements. There are no correct answers to these statements. They are designed for you to indicate if you agree or disagree with the ideas expressed. Place a (✓) checkmark in the appropriate boxes.	SD 1	D 2	A 3	SA 4
27. Once I start to work with the computer, I would find it hard to stop.				
28. Knowing how to work with computers will increase my job possibilities.				
29. I get a sinking feeling when I think of trying to use a computer.				
30. I could get good grades in computer courses.				
31. I will do as little work with computers as possible.				
32. Anything that a computer can be used for, I can do just as well some other way.				
33. I would feel comfortable working with a computer.				
34. I do not think I could handle a computer course.				
35. If a problem is left unsolved in a computer class, I would continue to think about it afterward.				
36. It is important to me to do well in computer classes.				
37. Computers make me feel uneasy and confused.				
38. I have a lot of self-confidence when it comes to working with computers.				
39. I do not enjoy talking with others about computers.				
40. Working with computers will not be important to me in my life's work.				

SECTION II: SELF-EFFICACY SCALE

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

Please place a checkmark (✓) in the column that most closely matches your opinion on each of the following items.	SD 1	D 2	N 3	A 4	SA 5
1. I like to grow house plants.					
2. When I make plans, I am certain I can make them work.					
3. One of my problems is that I cannot get down to work when I should.					
4. If I can't do a job the first time, I keep trying until I can.					
5. Heredity plays the major role in determining one's personality.					
6. It is difficult for me to make new friends.					
7. When I set important goals for myself, I rarely achieve them.					
8. I give up on things before completing them.					
9. I like to cook.					
10. If I see someone I would like to meet, I go to that person instead of waiting for him or her to come to me.					
11. I avoid facing difficulties.					
12. If something looks too complicated, I will not even bother to try it.					

Please place a checkmark (✓) in the column that most closely matches your opinion on each of the following items.	SD 1	D 2	N 3	A 4	SA 5
13. There is some good in everybody.					
14. If I meet someone interesting who is very hard to make friends with, I'll soon stop trying to make friends with that person.					
15. When I have something unpleasant to do, I stick to it until I finish it.					
16. When I decide to do something, I go right to work on it.					
17. I like science.					
18. When trying to become friends with someone who seems uninterested at first, I don't give up very easily.					
19. When trying to learn something new, I soon give up if I am not initially successful.					
20. When unexpected problems occur, I don't handle them well.					
21. If I were an artist, I would like to draw children.					
22. I avoid trying to learn new things when they look too difficult for me.					
23. Failure just makes me try harder.					
24. I do not handle myself well in social gatherings.					
25. I very much like to ride horses.					
26. I feel insecure about my ability to do things.					
27. I am a self-reliant person.					
28. I have acquired my friends through my personal abilities at making friends.					
29. I give up easily.					
30. I do not seem capable of dealing with most problems that come up in my life.					

SECTION III: INNOVATIVENESS

Strongly Disagree	Disagree	Moderately Disagree	Undecided	Moderately Agree	Agree	Strongly Agree
1	2	3	4	5	6	7

ITEMS: Please check (✓) the appropriate response.	SD 1	DA 2	MD 3	UN 4	MA 5	A 6	SA 7
1. My peers often ask me for advice or information.							
2. I enjoy trying out new ideas.							
3. I seek out new ways to do things.							
4. I am generally cautious about accepting new ideas.							
5. I frequently improvise methods for solving a problem when an answer is not apparent.							
6. I am suspicious of new inventions and new ways of thinking.							

ITEMS: Please check (✓) the appropriate response.	SD 1	DA 2	MD 3	UN 4	MA 5	A 6	SA 7
7. I rarely trust new ideas until I can see whether the vast majority of people around me accept them.							
8. I feel that I am an influential member of my peer group.							
9. I consider myself to be creative and original in my thinking and behavior.							
10. I am aware that I am usually one of the last people in my group to accept something new.							
11. I am an inventive kind of person.							
12. I enjoy taking part in the leadership responsibilities of the groups I belong to.							
13. I am reluctant about adopting new ways of doing things until I see them working for people around me.							
14. I find it stimulating to be original in my thinking and behavior.							
15. I tend to feel that the old way of living and doing things is the best way.							
16. I am challenged by ambiguities and unsolved problems.							
17. I must see other people using new innovations before I will consider them.							
18. I am receptive to new ideas.							
19. I am challenged by unanswered questions.							
20. I often find myself skeptical of new ideas.							

SECTION IV: PROFILE CHARACTERISTICS

1. Gender
   ❑ Male ❑ Female

2. Age
   ❑ Under 30 ❑ 31 - 40 ❑ 41 - 50 ❑ 51 - 60 ❑ Over 60

3. Marital Status
   ❑ Single ❑ Married ❑ Widowed ❑ Divorced

4. Number of Children _____

5. Highest degree attained
   ❑ Bachelors ❑ Masters ❑ Ed. Specialist ❑ Doctorate

6. Building Level (Please check all that apply)
   ❑ Elementary ❑ Middle School ❑ High School

7. What is your current teaching status?
   ❑ Part-time substitute teacher ❑ Full-time substitute teacher
   ❑ Day trade teacher ❑ Part-time teacher
   ❑ Full-time teacher without contract ❑ Full-time contract teacher
   ❑ Other (please specify) _____

8. Please indicate the subject you teach _____

9. Is your current teaching job primarily in an area for which you were trained?
   ❑ Yes ❑ No (please explain) _____
   ❑ Other (please explain) _____

10. Number of Years in Education _____

11. Number of Years in Current Position _____

12. Do you have access to a computer? (Please check all that apply)
    ❑ Home ❑ Classroom ❑ Other (please explain) _____

13. Number of Years Using a Computer _____

14. My computer skills are
    ❑ Excellent ❑ Good ❑ Fair ❑ Poor

15. Would you be willing to participate in a follow-up telephone interview?
    ❑ Yes Phone No. _____ ❑ No

V. COMPUTER USE/CURRENT & INTENDED

0 Never				1 Minimal	2 Occasional	3 Often			
CURRENT USE				Please check (✓) one response that applies for both current use and intended use using the below rating scale as your guide.		INTENDED USE			
0	1	2	3			0	1	2	3
				PERSONAL					
				1. Home finance.					
				2. Personal correspondence.					
				3. Enrichment					
				CLASSROOM INSTRUCTION					
				4. Using computers to help students develop study skills.					
				5. Reinforcement of student knowledge through drills and practice.					
				6. Classroom research.					
				CLASSROOM MANAGEMENT					
				7. Develop lesson plans.					
				8. Attendance records.					
				9. Student assessment.					

THANKS FOR COMPLETING THIS SURVEY!

If you would like to make any comments, please write them here.

REFERENCES

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ABSTRACT

PREDICTORS OF TEACHER USE OF TECHNOLOGY

by

GAIL ANN NORTHCUTT

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Advisor: Dr. Rita Richey

Major: Instructional Technology

Degree: Doctor of Philosophy

This study examined the predictors of computer use by teachers in a semi rural school district. The variables examined were intended personal use of computers, intended use of computers for classroom instruction, and intended use of computers for classroom management. One hundred and forty six teachers at four elementary schools, one middle school, and one high school were surveyed.

Three instruments previously published in the literature were combined to form a self reporting survey questionnaire for this study: Computer Attitude Scale developed by Loyd and Gressard, Self-Efficacy Scale developed by Sherer, et al.and Innovativeness Scale (IS) by Hurt, Joseph and Cook.

The results of this study indicated that younger, less experienced teachers with a higher level of educational attainment and greater self-reported computer ability are more likely to demonstrate a greater appreciation for computer usefulness and computer liking. These teachers are more likely to intend to use computers for personal use, classroom instruction, and classroom management. High degrees of self-efficacy and innovativeness were not found to be significant predictors of teacher use of computers. Elementary school teachers were found to indicate a greater appreciation for computer usefulness

than high school or middle school teachers, and to intend to use computers for classroom instruction.

Professional development activities for teachers may be designed from a constructivist perspective, and based on research findings related to adult learning theory. Other variables, such as participation in professional development, personal development, and teachers' current educational status may be topics for additional research.

AUTOBIOGRAPHICAL STATEMENT

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National Council of Supervisors of Mathematics
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