To the Graduate Council:

I am submitting herewith a dissertation written by Paul R. Wallace entitled "Diffusion of Internet Adoption: A Study of the Relationship Between Innovativeness, the Attitude of Teachers Toward Using the Internet, and Internet Use." I have examined the final copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Education.

Lonnie McIntyre, Major Professor

We have read this dissertation
and recommend its acceptance:

Donald Dessart

Michael Sims

Dianne Whitaker

Accepted for the Council:

Associate Vice Chancellor and
Dean of The Graduate School

Diffusion of Internet Adoption: A Study of the Relationship Between Innovativeness, the Attitude of Teachers Toward Using the Internet, and Internet Use

A Dissertation
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ABSTRACT

There has been a recent push to connect public schools to the Internet, lead by state and federal government agencies and supplemented by funds from private enterprise. However, little research has yet been gathered with respect to usage measures, attitudes, demographics, personality types, and other significant variables contributing to teachers' adoption of Internet technologies. Without this knowledge, it is doubtful that effective decisions about use of the Internet for teaching and learning can be made. Therefore, the purpose of this study was to investigate the relationship between innovativeness, Internet use, demographic variables, and the attitude of teachers toward the use of the Internet.

The population for this study was the full-time teaching faculty of a school system in Tennessee where dedicated Internet access existed in each school building. The instrument was a self-report questionnaire comprised of measures for innovativeness, attitude toward the use of the Internet, Internet use, and demographic data. Underpinning this study is the diffusion research tradition, which relates to the transfer of new ideas within a social system. The diffusion process is the spread of a new idea from its source of invention or creation to the ultimate users or adopters. Diffusion entails the communication or dissemination of an idea and the culmination of its adoption by members of a social system.

In previous research, innovative adopter types have been found to possess higher overall positive attitudes towards new experiences and novel stimuli. Results of this study corroborate these findings, as it was determined that the mean Internet attitude scores of innovators were significantly higher than other adopter groups. In

addition, scores for Internet use were significantly higher for innovators than for laggards. The relationship between adopter type and Internet use in this population is that innovators and majority members are the ones who have used the Internet, while laggards have little experience. Further tests show that the younger age groups, females, and general subject teachers possessed higher mean scores for innovativeness than other groups.

Previous studies have investigated the relationship between computer use, anxiety, attitude, experience, and training. This study examined Internet specific variables with respect to computer attitudes and usage in the general K-12 teacher population. Results show that there exists a significant positive relationship between increased attitudes toward using the Internet and an increase in teachers' Internet use. Male teachers had significantly lower Internet attitude scores than female teaches, this was found to be related to a small group of male math teachers who also exhibited low scores for Internet use. It is believed that low Internet attitude scores for this group are related to their low levels of Internet use.

Based upon the findings of this study, it is suggested that Internet training be used as a way to provide late majority and laggard adopters with Internet experience; thereby increasing attitude toward the innovation, and increasing subsequent use. Further research in this area could involve employing alternative methods for identifying innovators, administering an experimental treatment group design to uncover differences in training specific to adopter types, and investigating specific educational uses of the Internet.

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CHAPTER I

INTRODUCTION

The focus of this study involves the relationship between teachers' innovativeness, attitude toward the use of the Internet, and Internet use. This first chapter begins with an introduction to the historical and theoretical framework of the study; followed by a description of the needs addressed by the study, the purpose for the study, assumptions and limitations of the study, and definitions for key concepts.

Historical Framework

There has been a recent push to connect public schools to the Internet. This initiative is lead by state and federal government agencies, and supplemented by funds from government and private enterprise. In 1997 alone, Congress committed 200 million of an expected total of 2 billion dollars for connecting public and private schools to the Internet. Additionally, in 1996 the Federal Communications Commission created a 2.2 billion dollar private fund to provide enhanced telecommunications services to schools and libraries. In spite of these funding initiatives, little research has yet been gathered about usage measures, attitudes, demographics, personality, and other significant variables contributing to teachers' adoption of these new technologies. Without this knowledge, it is unlikely that competent decisions about use of the Internet for teaching and learning can be made. Moreover, lessons from previous

technological introductions in education (Cuban, 1986; Hodas, 1993) raise doubt as to the potential success of telecommunications in the classroom.

Telecommunications in Education

The Internet is a global wide area network of interconnected networks that all use a set of standards allowing computers on different networks to communicate. This network was originally designed in the 1960s to protect communication signals from catastrophic events, as well as to serve military institutions worldwide. The Internet has since developed into an international system of linked computer networks (Web Words, 1997; Brown, 1996). It presently facilitates data communication services such as the world wide web, telnet, file transfer protocol, gopher, electronic mail, and newsgroups.

Educational resources available on the Internet are increasing at a rate that makes it impossible to provide an accurate count. Estimates of all Internet host computers world wide in 1997 totaled 16 million, up from just over 9 million in 1996. In addition, it is estimated that in 1997 there were close to 55 million adult users of the Internet in the United States alone (FIND/SVP, 1997). The level of Internet growth, depicted in Figure 1-1, has doubled each year since 1991.

Telecommunications systems in schools have the potential to provide the tools for eliminating the isolation of classrooms, as well as for the possibility for bringing unlimited resources into the daily lives of teachers, administrators, and students. Online databases of reference materials allow instant access to text, images, sound, and video. Teachers and administrators can communicate within

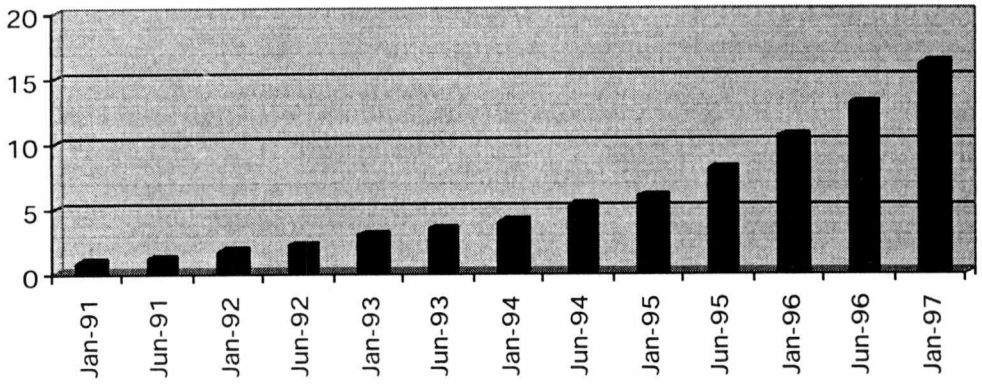

Figure 1-1. Number of Internet Hosts from 1991 to 1997
Source: Network Wizards (1997). *Host count graph.* Available Online: http://www.nw.com/

and among schools systems, parents and students can use the Internet to interact with teachers and administrators, and students can discuss class information and communicate with other students anywhere in the world.

Theoretical Framework

Underpinning this study is the diffusion research tradition, which explains the transfer of new ideas within a social system. The theory of diffusion is characterized as the process by which a new idea spreads throughout a social system. It is held that the diffusion process is the spread of a new idea from its source of invention or creation to the ultimate users or adopters. Thus, diffusion entails the communication or dissemination of an idea and the culmination of its adoption by members of a social system.

Diffusion of Innovations

Everett Rogers' *Diffusion of Innovations* (1995) provides an overview of how an idea is diffused into a social system. It addresses both the spread of innovations among individuals, as well as innovations' dissemination within organizations. According to Rogers, diffusion is characterized by four elements contained within the process; whereby (1) an innovation is (2) communicated through certain channels, (3) over time, and among members of a (4) social system. Each of these elements is examined in detail in the following sections, and an overview of the innovation-decision process is presented in Figure 1-2.

Element One: The Innovation

The concept of an "innovation" is the first element examined in the discourse on diffusion. Rogers (1995) defines innovation as "an idea, practice or object that is perceived as new by an individual or other unit of adoption" (Rogers, 1995, p. 11). The perceived newness of an idea determines an individual's reaction to it. Furthermore, the innovation is assumed to be an improvement over past practice, and is expected to benefit the social system into which it is introduced. Research into adoption of innovations addresses how early adopters differ in relation to later adopters, and the extent to which perceived attributes of an innovation influence its flow of adoption.

There are five primary characteristics of innovations that help illustrate the rate of their adoption: (1) Relative Advantage, (2) Compatibility, (3) Complexity, (4) Trialability, and (5) Observability. These characteristics and their definitions are summarized in Table 1-1.

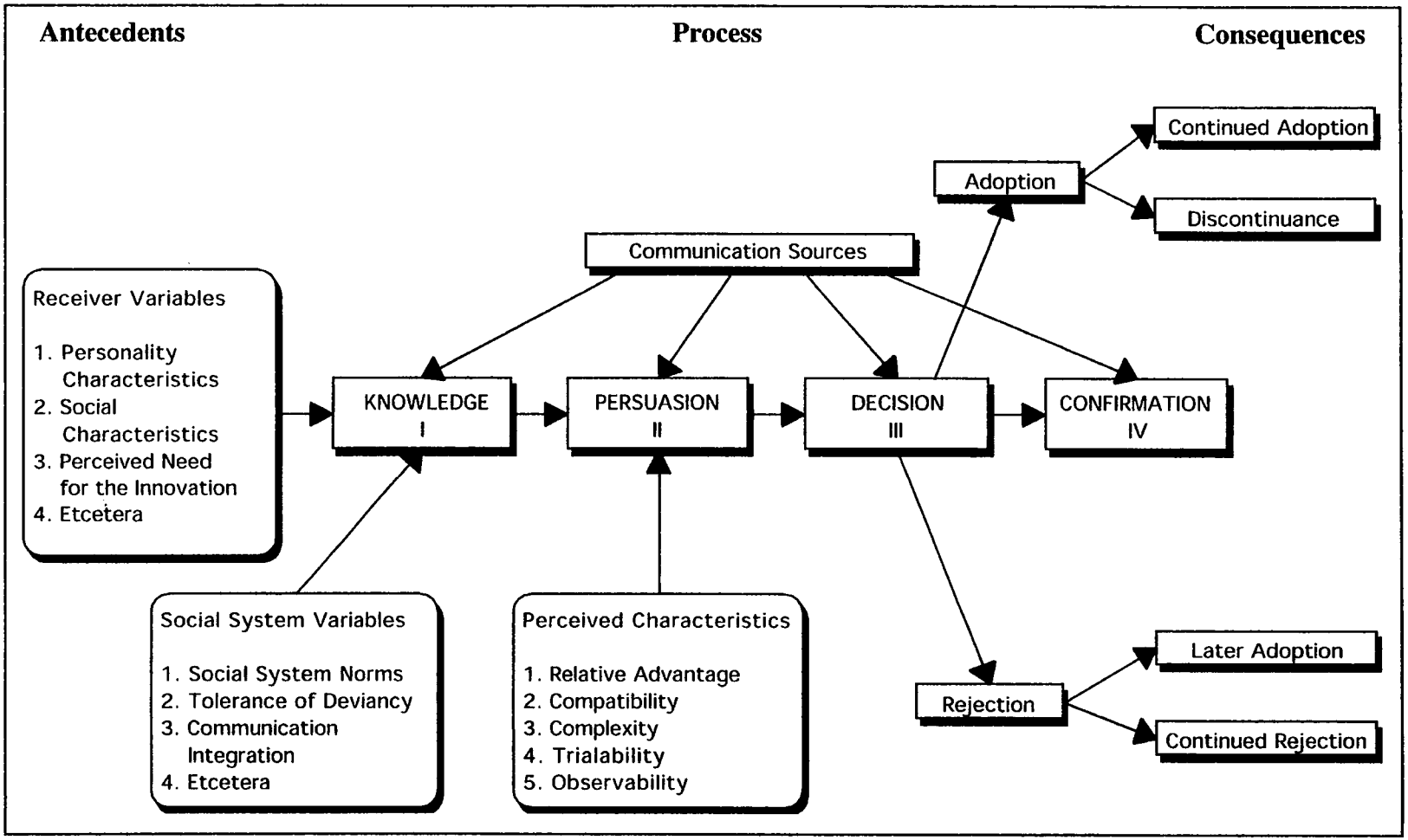

Figure 1-2. **Paradigm of the Innovation-Decision Process**
Source: Rogers, E. M., & Shoemaker, F. F. (1971). *Communication of innovations.* New York: The Free Press.

Table 1-1. Characteristics of Innovations

Characteristic	Definition
Relative Advantage	The degree to which an innovation is perceived as better than the idea it supersedes. The greater the perceived relative advantage, the more rapid the innovation's rate of adoption.
Compatibility	The degree to which an innovation is perceived as being consistent with existing values, past experiences, and needs of potential adopters. An idea that is incompatible with the values and norms of a social system will not be adopted as rapidly as an innovation that is compatible.
Complexity	The degree to which an innovation is perceived as difficult to understand and use. Some innovations are readily understood by most members of the social system; others are more complicated and will adopt more slowly.
Trialability	The degree to which an innovation may be experimented with on a limited basis. New ideas that can be tried on an "installment plan" will generally be adopted more quickly than those innovations that cannot be tested.
Observability	The degree to which the results of an innovation are visible to others. The easier it is for an individual to see the results of an innovation, the more likely the individual is to adopt it.

Adapted from: Rogers, E. M. (1995). *Diffusion of innovations,* fourth edition. New York: The Free Press.

Element Two: Communication Channels

Communication, the second element in the diffusion process, is defined as "the process by which participants create and share information with one another in order to reach a mutual understanding" (Rogers, 1995, p. 17). The diffusion process involves a series of steps which eventually lead to the exchange of knowledge: (1) an innovation, (2) an individual who has knowledge of the innovation, (3) another individual who does not yet have knowledge of the innovation, and (4) a communication channel connecting the two individuals. Diffusion is a particular type of communication where the information that is exchanged is in the form of new ideas.

Element Three: Time of Adoption

The third element in the diffusion process relates to the time variable of adoption. There are three components associated with the time of innovation adoption: (1) the innovation-decision process, (2) adopter categories, and (3) the rate of adoption.

The first component, the innovation-decision process, is the method by which an individual passes from first knowledge of an innovation to the formation of an attitude toward the innovation (Rogers, 1995). This procedure is followed by a specific decision by that individual to (1) adopt or reject the idea, (2) to implement a new idea, and (3) to confirm the innovation-decision. The innovation-decision process can be summarized in the following five steps: (1) Knowledge, (2) Persuasion, (3) Decision, (4) Implementation, and (5) Confirmation. The principal characteristic of each of these steps is outlined in Table 1-2.

Table 1-2. Five Main Steps in the Innovation-Decision Process

Step	Characteristic
Knowledge	When an individual is exposed to the innovation and gains some understanding of how it functions.
Persuasion	When an individual forms a favorable or unfavorable attitude toward the innovation.
Decision	When an individual engages in activities that lead to a choice to adopt or reject the innovation.
Implementation	When an individual puts the innovation into use. In addition, re-invention will likely to occur at this stage.
Confirmation	When an individual seeks reinforcement of an innovation. The individual may, however, reverse this previous decision if exposed to conflicting messages about the innovation.

Adapted from: Rogers, E. M. (1995). *Diffusion of innovations,* fourth edition. New York: The Free Press.

The second component related to time of adoption is the existence of adopter categories. Research in the adoption of innovations reveals a number of adoption personality types, defined in relation to one's readiness or willingness to embrace new ideas. Findings communicate that members of adopter categories share similar personality features and possess common demographic characteristics. Five adopter types have consistently emerged in the literature: (1) innovators, who comprise 2.5% of the population; (2) early adopters, who represent 13.5% of the population; (3) early majority, representing 34% of the population; (4) late majority, who also make up 34% of the population; and (5) laggards, who comprise 16% of the population. These adopter categories, as they relate to personality characteristics specific to the adoption of technological innovations, are illustrated in Table 1-3.

A successful innovation will be adopted by members of a social system in the following order: (1) innovators, (2) early adopters, (3) early majority, (4) late majority, and perhaps (5) the laggards.

The third and final component, in respect to time of adoption, distinguishes the rate of adoption. This is a time variable which allows researchers to classify adopter categories and to plot diffusion curves. Research has shown that the adoption of an innovation follows a normal, bell-shaped curve when plotted over time on a frequency basis, as shown in Figure 1-3.

A concept related to time of adoption is "critical mass." This concept refers to "the point at which enough individuals have adopted an innovation so that the innovation's further rate of adoption becomes self-sustaining" (Rogers, 1995, p. 313). Critical mass typically occurs when approximately 15 to 20

Table 1-3. Characteristics of Adopter Categories

Category	Characteristics
Innovators	Experimentalists who latch onto an innovation as soon as it appears. Their interest lies primarily in the innovation itself, rather than with its application.
Early Adopters	Visionaries who blend an interest in innovation with a concern for significant applications. They look for breakthroughs in instructional methods or learning effectiveness that new innovations for technology enable.
Early Majority	Pragmatists who represent the first half of the mainstream. They adopt a "wait-and-see" attitude toward new applications of innovation, and require solid references and examples of successes before adopting.
Late Majority	The conservative or skeptical latter half of the mainstream. They accept innovation late in the game, once the change has already become well-established among the majority.
Laggards	The last group of potential adopters are, understandably, the most likely never to adopt at all. Laggards are not only unlikely to employ innovations, but also may be antagonistic to their use by others.

Adapted from: Geoghegan, W. H. (1994). *What ever happened to instructional technology?* Paper presented at the 22nd Annual Conference of the International Business Schools Computing Association. Baltimore, Maryland.

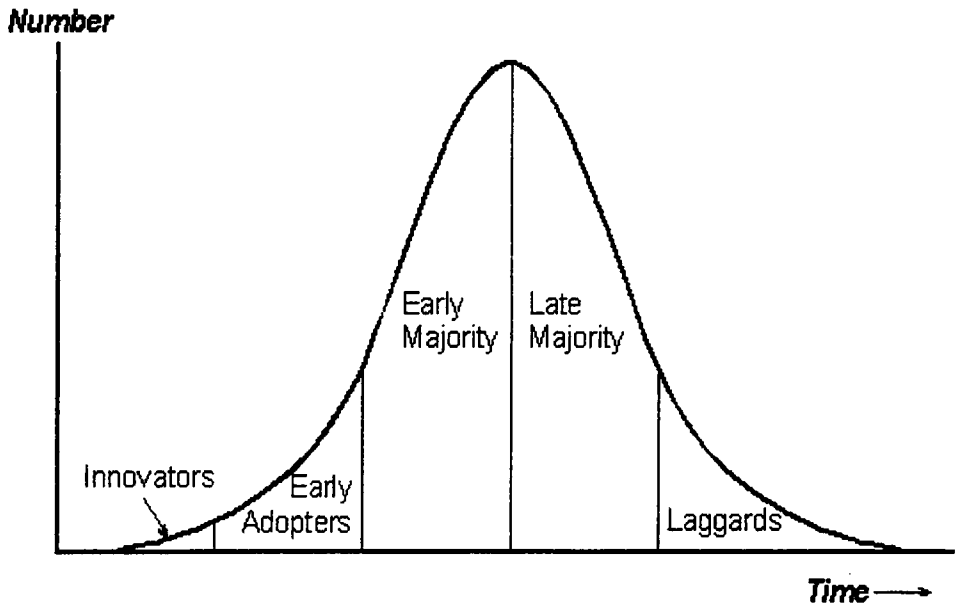

Figure 1-3. **Bell-Shaped Curve of Adopter Categories**
Source: Rogers, E. M. (1995). *Diffusion of innovations,* fourth edition. New York: The Free Press.

percent of a target population have adopted an innovation. In relation to adopter categories, critical mass takes place at the point where the early majority begins the adoption process.

Moore's (1991) observation of critical mass reveals that as an innovation passes from one adopter group to the next, there emerge particular and specific reasons for progress to fail. Specifically, the most significant potential for failure lies at the point of passage between early adopters to early majority. The difference between these two adopter groups is significant in many personality characteristics, outlined in Table 1-4.

Moore (1991) asserts that if the innovation fails to cross this adapter gap, described as a "chasm" that separates early adopters from the mainstream, then it

will never succeed in reaching more than approximately 15 percent of the population. Moore's "chasm" in the adoption process is depicted in Figure 1-4.

The implications of Moore's (1991) theory have influenced the field of Instructional Technology. Geoghegan (1994) explores how early adopters of educational technologies have often undermined the subsequent adoption of such technological advances by mainstream faculty. Technology in education benefits the "technologist" population within schools, those who are the natural innovators and early adopters. It is important to understand that this community of technologists is guided by a completely different form of needs, and requires a completely different form of support and guidance than that required by later adoption groups. He concludes that the chasm in needs between adopter categories is one of the principal reasons for the failure of many technological advances in education.

In an attempt to outline the division between early adopters and later adopters, Geoghegan (1994) presents the following three concepts to illustrate the separation: (1) the available tools, in the form of software and hardware, are often difficult for the general population to use and often not appropriate for the task; (2) support often exists solely in the form of money and training for hardware and software, rather than for guidance in the use of technology in the classroom; and (3) the focus of instructional uses of technology usually concentrate on the latest "killer applications" that offer the potential for more radical change in instructional methods rather than upon those that offered the incremental advances favored by the mainstream" (Geoghegan, 1994).

Table 1-4. Differences Between Early Adopter and Early Majority

Early Adopter	Early Majority
Favor revolutionary change	Favor evolutionary change
Visionary	Pragmatic
Project oriented	Process oriented
Risk takers	Risk averse
Willing to experiment	Want proven applications
Generally self-sufficient	May need significant support

Source: Geoghegan, W. H. (1994). *What ever happened to instructional technology?* Paper presented at the 22nd Annual Conference of the International Business Schools Computing Association. Baltimore, Maryland.

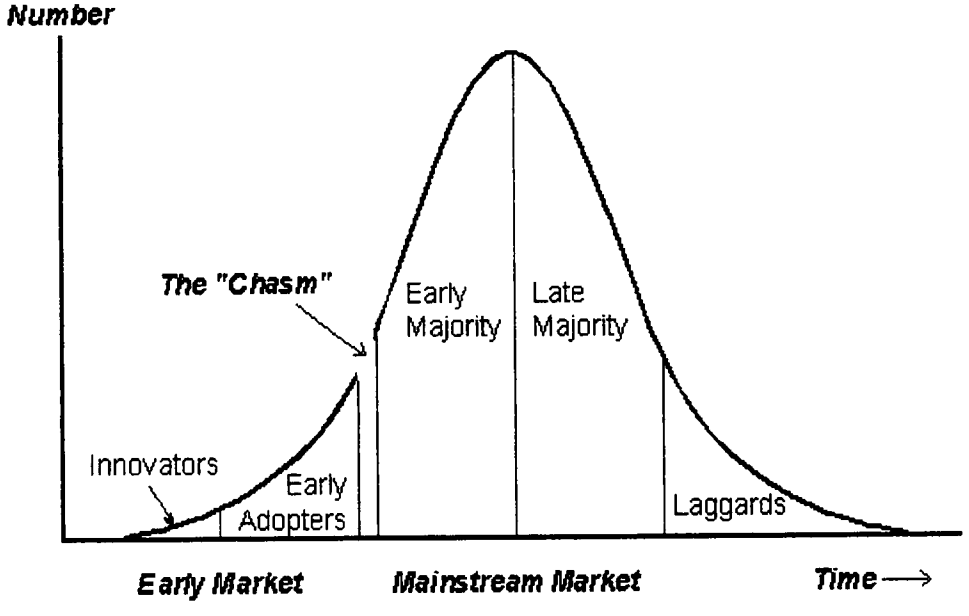

Figure 1-4. The Chasm in the Adoption Process
Adapted from: Moore, G. A. (1991). *Crossing the chasm.* New York: Harper Collins.

Element Four: The Social System

The social system is the fourth and final element in the theory of diffusion of innovations. A social system is defined as "a set of interrelated units that are engaged in joint problem solving to accomplish a common goal" (Rogers, 1995 p. 23). This constitutes a boundary within which an innovation is dispersed. The social system has the ability to impact on the diffusion process through a number of circumstances, including: (1) the social structure, (2) the effect of norms, (3) the roles of opinion leaders and change agents, (4) types of innovation decisions, and (5) the consequences of innovation. These circumstances are outlined in Table 1-5 and further described in the following sections.

The first type of circumstance in this discussion is social structure. Social structures can be formal, providing regularity and stability to social behaviors; or informal, existing as interpersonal networks among individuals. The importance of social structures in diffusion research is tied to their ability to "facilitate or impede the diffusion of innovations in a system" (Rogers, 1995, p. 25). Social norms relate to the range of admissible behavior in a social system, and exist as a guide for appropriate behavior.

Opinion leadership, the second type of circumstance related to social systems, is "the degree to which an individual is able to influence other individuals' attitudes or overt behavior informally in a desired way with relative frequency" (Rogers, 1995, p. 27). Interestingly, the most innovative members of a social system possess the least credibility in respect to opinion leadership. Innovators are, it seems, often deviant in their regard to the systems' norms. Individuals who possess acceptable opinion leadership earn their reputation by way of

Table 1-5. Five Circumstances of Social System Impact

Circumstance	Impact
Social Structure	Social structures facilitate or impede the diffusion of innovations in a system.
Effect of Norms	Norms relate to the range of admissible behavior in a social system, and exist as a guide for appropriate behavior.
Roles of Opinon Leaders and Change Agents	Opinon Leaders influence other individuals' attitudes or overt behavior informally in a desired way with relative frequency. Change agents are members of the system who actively seek the influence of opinion leaders.
Types of Innovation Decisions	The decision to adopt an innovation can be made by either one individual authority, or by the entire social system in a collective decision process.
Consequences of Innovation	Consequences of an innovation relate to the impact that the adoption or rejection has on an individual or social system.

Adapted from: Rogers, E. M. (1995). *Diffusion of innovations*, fourth edition. New York: The Free Press.

such capabilities as technical proficiency, social accessibility, and conformity to the systems' norms.

Change agents are members of the system who actively seek the influence of opinion leaders. Change agents most often represent the interest of a change agency, an organization attempting to influence the innovation-decision direction of a social system. The individuals, under the auspices of change agencies, typically attempt to procure the adoption of innovations; however, on occasion change agents may try to prevent or slow diffusion.

The fourth circumstance of social systems is the concept of innovation decisions. The decision to adopt an innovation can be made by either one individual authority, or by the entire social system in a collective decision process. Rogers (1995) outlines three types of decision making strategies, or "innovation-decisions". These strategies are: (1) optional innovation-decisions, (2) collective innovation-decisions, and (3) authority innovation-decisions. The characteristics for each innovation-decisions type are summarized in Table 1-6.

Finally, the fifth circumstance of social systems is the possibility of consequences caused by the diffusion process. These consequences relate to the impact that the adoption or rejection of an innovation has on an individual or social system.

Summary of Diffusion Theory

The theoretical perspective of diffusion is addressed by Everett Rogers in *Diffusion of Innovations* (1995). He identifies the diffusion process as that by which an innovation is communicated through certain channels, over time, and

Table 1-6. Types of Innovation-Decisions

Type	Characteristic
Optional	Choices to adopt or reject an innovation are made by individuals, independent of the decision of other members of the system.
Collective	Choices to adopt or reject an innovation are made by consensus among the members of a system. Once made, all the units in the system generally must conform to the system's decision.
Authority	Choices to adopt or reject an innovation are made by those few individuals in the system who possess power, status, or technical expertise. Other members of the system have little or no influence in the decision; but must, nevertheless, implement the decision.

Adapted from: Rogers, E. M. (1995). *Diffusion of innovations,* fourth edition. New York: The Free Press.

among members of a social system. There are five attributes of an innovation: (1) relative advantage, (2) compatibility, (3) complexity, (4) trialability, and (5) observability. The innovation-decision process is that by which an individual moves from first knowledge of an innovation, to forming an attitude, to the decision to adopt or reject, to implementing the new idea, and lastly to confirmation of the decision to adopt. This process is made up of the following five stages: (1) knowledge, (2) persuasion, (3) decision, (4) implementation, and (5) confirmation. Adopters fall into one of five categories based upon time of adoption: (1) innovators, (2) early adopters, (3) early majority, (4) late majority, and (5) laggards. Opinion leaders and change agents play an important role in the diffusion process. Opinion leaders exert influence on the adoption of an innovation, change agents influence the adoption process in the direction guided by a change agency.

Need for the Study

The need for this study was shaped by a variety of sociological, methodological, and research concerns. These issues included (1) the timeliness of studying variables, (2) the researcher's interest in the population of K-12 teachers, (3) the researcher's interest in the general teaching population, (4) the development of a valid and reliable Internet attitude scale, and (5) the examination of the relationship between Internet attitude and subsequent use. Each of these issues are explored in the following sections.

Timeliness of the Study

As a new technology innovation is introduced into the teaching population it is important for researchers in Instructional Technology to record variables such as attitudes, usage measures, personality types, and demographics. The lack of uniform Internet access within specific school buildings and throughout entire school systems was, at the time of this study, an obstacle to measuring such variables in relation to the Internet. However, access to the Internet increased enormously in public schools during 1997. Entire school districts were then capable of providing teachers both access to the Internet and training on its use. The ability to record and examine the relationship between the above variables was a goal of this study.

Focus on K-12 Teachers

As mentioned previously, vast sums of funding are reserved for developing the telecommunications infrastructure within our public schools, yet results from the literature reveal little concerning the adoption process of these technologies in K-12 teacher populations. The majority of studies related to the diffusion of Internet use in education consist of descriptive and advocacy compositions, whereas the few experimental studies that exist focus on diffusion of media and technology in higher education (e.g., Finlay & Finlay, 1996; Huang, 1993). There exists a need for empirical studies related to the adoption and diffusion of Internet use in the K-12 teacher population.

Focus on the General Teaching Population

The literature of diffusion research, in studies pertinent to Instructional Technology, has historically focused on "techies" and other technologically competent personnel (e.g., Finlay and Finlay, 1996; Huang, 1993). These individuals usually hold positions as technology coordinators, computer teachers, media specialists, and librarians. They are, by virtue of their positions, the early adopters of educational technologies. As expressed in the literature (Moore, 1991; Geoghegan, 1994), this group of early adopters have frequently prevented the technology adoption of mainstream faculty through the advocacy of models that are largely irrelevant to the needs and skills of the majority. Generalization from studies focusing solely on the technologically competent population is questionable in relation to the general teaching population. It is for that reason that this study examined the diffusion of Internet use within the general teaching population.

Development of an Internet Attitude Scale

Reports (Achenbaum, 1966; Robertson, 1971) indicate that a positive attitude toward a product is associated with its subsequent adoption and use. In order to understand the ultimate adoption of Internet technologies in schools, it is necessary to assess the attitude of teachers toward their use of the Internet. In respect to this methodological construct, however, the literature at the time of this study contained no valid and reliable scale serviceable for measuring such attitudes. One of the aims of this study, therefore, was the development of a valid

and reliable Internet attitude scale to facilitate comparative and accumulative research in this area.

Examine Internet Attitude and Internet Use

At the time of this study there were no published experimental studies that conclusively linked increased positive attitude toward the Internet to increased use of the Internet. As mentioned previously, however, there existed evidence in the literature of both consumer studies (Achenbaum, 1966) and Instructional Technology (Davidson & Richie, 1994) that respectively link an individual's positive attitude toward a product with increased use of that product, and a teacher's positive computer attitude with effective implemented into the classroom. Therefore, an experimental study employing an Internet attitude measure, combined with data relevant to Internet use, would add to the understanding of this relationship. This study was designed to provide such measures, and the subsequent analysis of the relationship between Internet attitude and Internet use.

Purpose of the Study

The primary purpose of this study was to measure the interrelationships between innovativeness, the attitude of teachers toward using the Internet, Internet use, and demographic variables.

Research Questions

The following research questions were formulated for this study:

1. What relationship exists between adopter category types and the attitude of teachers toward the use of the Internet?
2. What effect does adopter type have on the Internet use variables: (1) history of Internet use, (2) frequency of teachers' Internet use, (3) variety of teachers' Internet use, and (4) location of teachers' Internet use?
3. What effect do demographic variables: (1) gender, (2) grade level, (3) subject area, (4) teaching experience, (5) level of education, (6) age, and (7) annual household income have on the innovativeness level of teachers?
4. What effect does attitude toward the use of the Internet have on the Internet use variables: (1) history of teachers' Internet use, (2) frequency of teachers' Internet use, (3) variety of teachers' Internet use, and (4) location of teachers' Internet use?
5. What effect do demographic variables have on the attitude of teachers' toward the use of the Internet?
6. What effect do demographic variables: (1) gender, (2) grade level, (3) subject area, (4) teaching experience, (5) level of education, (6) age, and (7) annual household income have on the Internet use variables: (1) history of teachers' Internet use, (2) frequency of teachers' Internet use, (3) variety of teachers' Internet use, and (4) location of teachers' Internet use?

Assumptions of the Study

There existed certain assumptions formed by the researcher that are identified:

1. The Innovativeness Scale (Hurt, Joseph, and Cook, 1977) is a valid and reliable instrument.
2. The Internet Attitude Scale, developed by the researcher, is a valid and reliable instrument.
3. The researcher was employed to conduct an Internet workshop for the teaching staff of the school system in December 1996. It is assumed that this association did not bias participants' answers to the survey questions.
4. Participants in this study responded to the survey statements and demographic questions honestly, accurately, and thoughtfully.

Operational Definitions

The following definitions were employed for use in this study:

Attitude — Attitude is defined to be comprised of three components: (1) affective, (2) cognitive, and (3) behavioral. The affective component consists of a person's evaluation of, liking of, or emotional response to the object or person. The cognitive component is conceptualized as a person's beliefs about, or factual knowledge of the object or person. The behavioral component includes the person's overt behavior directed toward the object or person (Simonson, 1979).

Early Adopter	Early Adopters are visionaries who blend an interest in technology with a concern for significant professional problems and tasks. They look for breakthroughs in instructional methods or learning effectiveness that new applications for technology enable (Geoghegan, 1994).
Diffusion	Diffusion is the process by which an innovation spreads. The diffusion process is the spread of a new idea from its source of invention its ultimate users or adopters. Diffusion involves the communication or dissemination of an idea, and culminates in its adoption by individuals (Rogers, 1995).
Electronic Mail	Electronic mail, or e-mail, is an electronic communication system designed to allow for the sending and receiving of person-to-person or group messages across a computer network. Invented in 1972 by Ray Tomlinson to send messages across an early distributed network, electronic mail is the most widely used of all Internet services (Brown, 1996).
FTP	FTP, short for File Transfer Protocol, is an Internet protocol used for downloading and uploading files to a remote server. Using the FTP protocol, one can access Internet sites to transfer text and binary files (Web Words, 1997).

Gopher

Gopher is an Internet protocol established for indexing and retrieving files. This hierarchical menu structure was originally created at the University of Minnesota (whose are known as the "Golden Gophers") and first appeared on the Internet in 1991. Gopher clients and servers spread rapidly across the Internet during the early 1990s. However by 1994, Gopher services were superseded, both in ease of use and in popularity, by the HyperText Transport Protocol (HTTP) employed for the world wide web (Brown, 1996).

Innovativeness

The degree to which an individual is relatively early in adopting new ideas than the other members of the social system (Rogers, 1995).

Innovator

Innovators are experimentalists who latch onto new ideas as soon as they appear. Their interest lies primarily in the innovation itself, rather than with its application to significant problems (Geoghegan, 1994).

Internet

The Internet is a global wide area network of interconnected networks that use a set of standards to allow computers on different networks to communicate. Originally designed in the 1960s to protect communication signals from catastrophic events, and to serve military institutions worldwide,

the Internet has since developed into an international system of linked computer networks. The Internet facilitates data communication services such as the World Wide Web, Telnet, File Transfer Protocol, Gopher, Electronic Mail, IRC/ Chat, and Newsgroups (Web Words, 1997).

Internet Use

Internet use is defined as consisting of four aspects: (1) history of Internet use, (2) frequency of Internet use, (3) location of Internet use, and (4) variety of Internet services used. History of Internet use is related to the length of time a participant has been using the Internet. Frequency pertains to the number of times one uses the Internet during a given period of time. Location is related to where one physically accesses the Internet. Variety is an indication of one's breadth of use measured by the number of Internet services used (Finlay and Finlay, 1996).

IRC/Chat

IRC, short for Internet Relay Chat, is an electronic message area of the Internet in which real-time conversations among two or more people take place in virtual "chat rooms" (Web Words, 1997).

Listserv

A Listserv is the most common type of electronic mail list, used extensively on the Internet for communication and

collaborative messaging. This system allows an individual to send e-mail to a specific Listserv address, where that message is recorded and sent to all subscribers of the mail-list. The Listserv concept originated on BITNET, but several varieties of the original implementation are now widely used throughout the Internet (Web Words, 1997).

Newsgroup — A Newsgroup is a popular bulletin board-type messaging service available on the Internet. Newsgroups are categorized in a hierarchical structure, with specific newsgroups available for a wide variety of individual topics. The first newsgroup was developed in 1979 using UUCP (UNIX-to-UNIX Communication Protocol) between Duke University and the University of North Carolina (Web Words, 1997).

Telnet — Telnet is an Internet protocol which allows users to access their account on a server or computer from a remote location. Telnet is often used to run a program on the server, such as an e-mail program to read or reply to electronic mail. (Web Words, 1997).

World Wide Web — The World Wide Web, or "the Web," is a global linked-document system that uses the Internet as a transportation mechanism. It is estimated that in 1997 there were as many

as 25 million Web users. The Web was designed around the HyperText Transport Protocol (HTTP), a standard that specifies how an application locates and acquires resources stored on other computers linked to the Internet. The World Wide Web was begun in 1990 when Tim Berners-Lee created the first HTTP server. The Web as an actual functioning system, however, did not go online until 1992 (Web Words, 1997; Brown, 1996; FIND/SVP, 1997).

CHAPTER II

REVIEW OF THE LITERATURE

The purpose of this chapter is to assess what is known about the literature on attitudes and innovativeness as they relate to this study. These concepts account for the two major divisions of this chapter. The first section deals with research on attitudes. This analysis of attitude studies includes a definition of attitudes, a description of the principle components of attitudes, related research on attitudes and other personality measures in instructional technology; and, lastly, an overview of the design and use of research tools for measuring attitudes. In the second section of this chapter, the analysis is shifted to the research on innovativeness. Similar to the treatment of attitude studies, the approach to innovativeness research in this chapter includes a definition of innovativeness, a description of the importance of understanding innovators, related research on innovativeness in respect to other personality characteristics; and, finally, an overview of the methods available for measuring innovativeness.

Research on Attitudes

The treatment of attitude in this chapter follows from a definition and description of the components of attitude to a lengthy review of attitude studies in the literature pertinent to this study. Characteristics related to attitude including gender differences, computer knowledge, computer experience, technology training, and computer coursework are reviewed in this study. Following the

discussion on the characteristics of computer and Internet attitudes is a discussion of the construction of attitude measures, outlining the types of scales used in attitude measures, measuring the validity and reliability of an instrument, and describing elements related to questionnaire design. The attitudes section of this chapter concludes with a summary account of scales designed to measure computer attitudes and Internet attitudes.

Definition of Attitude

Attitudes are considered to be organizations of beliefs about an object or situation that predispose an individual to respond to the object or situation in a preferential manner (Rokeach, 1966). Similar definitions of attitude make reference to elements such as motivational process and perceptual orientations (DeFleur and Westie, 1963). It is further held that attitudes can vary in the following methods: (1) by direction, either positive or negative; (2) by degree, the amount of positiveness or negativeness; and (3) by intensity, the amount of commitment with which a position is held (Fleming & Levie, 1978).

Attitudes are often thought to be comprised of the following three domains: (1) the affective, (2) the cognitive, and (3) the behavioral. An individual's affective, or feeling, domain of attitude is her emotional range related to an object. The cognitive realm of attitude is one's beliefs, knowledge, and evaluation of an object. Finally, the behavioral, or action-tendency, domain of attitude is defined as an "individual's readiness to behave overtly toward the object" (Robertson, 1971, p. 230).

Computer Attitude Studies

The attitude of teachers toward the use of computers is believed to influence both the acceptance of computers in schools, as well as their subsequent use. One of the primary goals of research on teachers' computer use is to encourage teachers to integrate computers into the curriculum. In order to illuminate the relationship between computer attitude and computer use, specific characteristics related to attitude including gender differences, computer knowledge, computer experience, technology training, and computer coursework are examined in this section.

Determinants of Computer Attitudes

Studies related to the computer attitudes of teachers, pertinent to this study, may be classified by the following characteristics (1) gender differences, (2) computer experience, (3) computer training, and (4) computer coursework. Each of these four characteristics will be examined in the following sections.

Gender Differences

Many descriptive and advocacy articles on computers and gender differences characterize females being more fearful of using technology than males, thus potentially left behind in respect to computer technology (Wiburg, 1994). Research on computer attitude and gender differences, however, does not substantiate these beliefs. For instance, in a meta-analysis of 82 studies conducted in the 1980s regarding attitude measurement, it was determined that males had higher positive attitudes in 36% of all studies, females in 23%, and both males

and females shared similar computer attitudes in 38% of the studies (Kay, 1992). Therefore, it was found that the greatest percentage showed no gender differences in attitudes.

Studies on attitude and gender differences within individual teacher populations and teacher education populations in the 1990s generally support this finding. For example, in recent studies on computer anxiety and computer phobia in teacher populations, (e.g., Rosen & Weil, 1995) conclude that there is no significant difference of these factors related to gender.

Similarly, in respect to computer use and computer attitude, Sheingold and Hadley (1990) found that there is no difference between computer use in the teacher population based upon gender. Likewise, in a study of personality variables and use of computers for teaching, there was no significant relationship between computer use and gender (Marchinkiewicz, 1994).

There are a number of studies on gender differences in teacher education programs. Since computers have been traditionally linked with science and mathematics, it is often held that males and females differ in the areas of computer interest and use. Results of a study by Okinaka (1992) reveal no significant differences in the areas of computer background, attitude, and topic interest between male and female educational computer technology students. Wallace and Sinclair (1995) found that teacher education students were less knowledgeable, more anxious, less confident, and have less liking for interactions with computers than computer science students. Among teacher education students, female students were found to be more anxious and less confident with computers than male students. These authors report, however, that there were no anxiety

differences between male and female students in the computer science course. Experience, not gender, was a more significant determinant of attitude in this and a number of related studies. The relationship between computer experience and attitude is investigated in the following section.

Computer Knowledge and Experience

In consumer studies research, increased levels of knowledge and experience in a product area have been shown to effect the nature of information process and storage, with respect to the influence of subsequent product use (Finlay & Finlay, 1996). Similarly, the assumption exists in the literature of instructional technology that increased knowledge of computers and experience with their use is related to an increase in attitude towards computing (e.g., Koohang, 1987, 1989). Summers (1990), for example, found that the negative attitudes teachers have toward computers in education can be directly attributed to their lack of knowledge and experience in computing. Others (McInerney, McInerney, & Sinclair, 1990) confirm this assumption, and report that increased computer experience generally lowers anxiety. It is held that computer use will cause less anxiety when it is a source of self-directed exploration or diversion rather than as part of formal instruction.

Computer users are generally found to possess more positive attitudes toward the use of computers than nonusers. Kristiansen (1991) holds that computer experience is related to the positive attitude of teachers toward their use. Likewise, Gilman (1991) designed a study to investigate the effects of a computer-based integrated learning system on the technology skills of teachers. The

author reported highly significant gains in the teachers' perceptions of their ability to use computers. This study concludes that a yearlong computer experience was significant in positively affecting teachers' attitudes toward instructional technology.

In respect to the relationship between computer experience and success in computer courses, Snelbecker and Glenn (1992) studied teachers who were taking courses to become qualified to serve as computer resource persons at either the elementary or secondary level. Results indicate that some form of previous experience with computers was predictive of successful achievement in computer courses.

A study by Finlay and Finlay (1996) reports on the relationship between knowledge and attitude toward the use of the Internet. They found that in a population of librarians working in Canadian universities, those who reported high levels of Internet knowledge were more positively predisposed to Internet use. It is believed that a general level of procedural and technical knowledge about the Internet appears to be beneficial to subsequent Internet use.

Computer Coursework

A number of studies in the literature of instructional technology reveal that participation in computer courses has a positive influence on the attitudes of inservice teachers toward computers and their computer use (e.g., Madsen & Sebastiani, 1987; Berger & Carlson, 1988). These results coincide with studies in teacher training that relate coursework to increased student attitudes in computer coursework, as well as in other areas of the curriculum. For example, a study by

Koontz (1992) concludes that coursework in the selection and utilization of instructional media for teacher education students can function as a primary factor in the development of positive attitudes.

Savenye's (1993) study looks at how attitudes among preservice teachers are influenced by participation in a computer literacy course. The research concludes that participation in the computer literacy course appeared to improve student attitudes toward computers and their computer use. Furthermore, after completing the course, students exhibited less anxiety and more confidence in respect to computer use.

There exist a number of studies outside the domain of teacher education that further validate the positive effect of computer coursework on increased attitude toward use. For instance, the main result of Kolehmainen's (1992) study indicated that a basic course in computer science reduced student anxiety toward computer use. He found that experience with computer equipment and the use of computers are the most significant determinants of reduced anxiety. Furthermore, the course had a positive effect on the students' impression of human-computer interaction and the impression of computers in the future. Another study (Reed et al., 1995) outside the field of teacher education, considered prior computer experiences and learning styles and their effect on computer anxiety of graduate students enrolled in an introductory computer course. The authors discovered that learners with more computer experience exhibited less computer anxiety at the beginning of the courses than those with less experience. However, at the end of the class, the attitudes of those students with prior experience did not differ significantly from those with little or no previous experience. These findings

indicate that computer coursework can be effective in bridging the gap between those with prior computer experience and those without prior experience.

Technology Training

The findings from studies of computer coursework on increased positive attitude in the teacher education population share similarities to those studies on inservice technology training within the teacher population. For instance, Standish (1993) reports that technology staff development increased the use of computers and technology by the teachers as indicated by an increased confidence level of teachers in the use of computers and technology.

Furthermore, a study by McCaslin and Torres (1993) indicates that teachers' beliefs, in respect to the educational value of computers and confidence in their use, are the most significant factors related to a variance in attitudes toward using computers in inservice education. They suggest that inservice teacher training could be enhanced by promoting computer confidence and by demonstrating the educational value of computer technology.

Attitude as a Predictor of Use

Researchers often assume a direct relationship between attitude and behavior. However, there exists a long-standing argument in attitude research as to whether attitudes can be shown to relate to behavior and some argue that often there is little relationship between attitude and act (Shrigley, 1990). Those who believe there is a connection can point to studies in both consumer research and instructional technology that respectively link an individual's positive attitude

toward a product with increased use of that product, for example a teacher's positive computer attitude with increase computer use.

In consumer studies research, Achenbaum (1966) reports a direct relationship between attitude and product use in four ways: (1) the more favorable the attitude, the higher the incidence of product usage, (2) the less favorable the attitude, the lower the incidence of product usage, (3) the more unfavorable people's attitudes are toward a product, the more likely they are to stop using it, and (4) the attitudes of people who have never tried a product tend to be distributed around the mean in the shape of a normal distribution. Moreover, Robertson (1971) summarizes studies in consumer research which find that changes in an individual's attitude toward a product directly relates to subsequent behavioral change toward its use.

In the field of instructional technology, an increase in teachers' computer attitudes has been shown to increase subsequent computer adoption (Davidson and Richie, 1994). They report that the attitudes of teachers toward the implementation of computers in the classroom is related to the success of such a program. The authors believe that computers can be effectively implemented into the classroom when teachers attitudes remain positive and anxieties remain low.

Measures of Attitudes

In general, there are five commonly used techniques for collecting attitude information: (1) self-report measures, (2) reports of others, (3) sociometric procedures, (4) observations, and (5) historical records. Each of these techniques has particular strengths and weaknesses, and are all represented in the literature

relative to measures of attitude-related behaviors. The most common type of attitude measure in the study of computers attitudes is the self-report measure. The following section explains the development and design of this type of measure.

Constructing Self-Report Attitude Measures

Self-report questionnaires have been employed extensively in research on computer attitudes in education. For this reason, there are a number of valid and reliable computer attitude scales in existence in the field of instructional technology. Miller (1991) recommends that once an appropriate scale for a construct is found, that scale should be used if it has the qualities of validity, reliability, and utility. The primary reason for using an existing scale is that "with such a scale, comparative and accumulative research is possible" (Miller, 1991, p. 174). Therefore, in the process of designing an attitude study, the researcher should attempt to locate an instrument designed to measure the relevant construct. The use of standardized measures will simplify the job of instrumentation, and allow the study to facilitate comparative and accumulative research in the field.

If no existing measure of an attitude construct is available, however, the researcher needs to construct one. Four types of scale techniques are commonly employed in the development of attitude measures: (1) the Thurstone equal-appearing interval scale, (2) the Likert-type scale, (3) the Guttman scale analysis, and (4) the semantic differential scale (Miller, 1991). Of these four, the Likert-type scale is the most popular; and the semantic differential scale is perhaps the most useful in measures of the affective component of attitude. These two scales,

Likert-type and semantic differential, are treated in more detail in the following sections.

Likert Scale

The Likert scale was originally developed by Likert (1932) and is one of the most widely used measurements in social science research. Edwards (cited in Adams & Schvaneveldt, 1985) outlines the seven typical steps by which Likert-type scales are developed and used: (1) a pool of related items are developed to reflect both a positive and negative orientation toward the research problem, (2) a 5 or 7-point response category containing a midpoint and anchored by "strongly disagree" and "strongly agree" is provided for each item in the pool, (3) items are split into negative and positive wording to improve respondents' thoughtfulness in response, (4) items in the original pool should be pared down to a reasonable number of item, (5) the item is administered to the population, (6) scoring of the scale is done through summating items resulting in a score determined by adding a participant's numbers for each item, and (7) the scale is further tested to define each item's individual effectiveness and revised as necessary.

Semantic Differential Scale

The semantic differential format measures an individual's orientation to an object or concept, and has been widely used in measures of affective attitudes. Osgood (1957) reports that such scales measure three principal components: (1) the individual's evaluation of the object or concept being rated, (2) the

individual's perception of the potency or power of the object or concept, and (3) the individual's perception of the activity of the object or concept. Semantic differential scales employ a seven-point rating placed between bipolar word groups. Participants rate the concept according to their "perception of the relatedness or association of the adjectives to the word concept" (Miller, 1991, p. 182).

Measuring Validity

Validity is an important dimension in attitude measures, as it is concerned with what is actually measured by the instrument. Adams and Schvaneveldt (1985) summarize four common types of validity: (1) face validity, (2) criterion-related validity, (3) content validity, and (4) construct validity. Table 2-1 identifies these types of validity with the corresponding research question that each addresses.

Two of the most common types of validity utilized in attitude scales are content validity and face validity. Content validity is the thoroughness or completeness of the measurement, with emphasis on the representativeness of sample items to the behavior under examination (Adams & Schvaneveldt, 1985). Face validity is merely the assumption of the researcher, based on appearance of the items, that the scale measures what it is designed to measure. Anastasi (1988) describes the difference between content and face validity in the following:

> Content validity should not be confused with face validity. The latter is not validity in the technical sense; it refers, not to what the test

> actually measures, but to what it appears superficially to measure. Face validity pertains to whether the test "looks valid" to the examinees who take it, the administrative personnel who decide on its use, and other technically untrained observers (Anastasi, 1988, p. 144).

When developing content validity, it is necessary to ensure that all relevant dimensions of the construct have adequate scale items to represent each dimension. This process is often done through a content review as described by Gronlund (1981): (1) a group of specialists on the topic should list the separate types of behavior included under the rubric of the subject matter, (2) the relative

Table 2-1. Types of Validity

Type	Research Question Addressed
Face validity	Does the assessment device appear to measure the subject matter under consideration?
Criterion-related validity	Does the individual's test score predict the probable behavior on a second variable (criterion-related measure)?
Content validity	Does the assessment device adequately measure the major dimensions of the behavior under consideration?
Construct validity	Does the assessment device appear to measure the general construct (element) it purports to measure?

Source: Adams, G. R., & Schvaneveldt, J. D. (1985). *Understanding research methods.* New York: Longman.

importance of each content area should be weighed, (3) a table specifying the percentages or number of items to be included under each area of content is constructed.

Measuring Reliability

Reliability is an important consideration in development of attitude measures. It is defined as the stability, consistency, or precision of a scale that can be demonstrated. Table 2-2 outlines methods for determining reliability as well as the corresponding research question that each method addresses. The method of showing reliability depends on the type of instrument being tested, and the intent of the researcher. Adams and Schvaneveldt (1985) summarize three common methods for determining reliability: (1) test-retest method, (2) equivalent-forms method, and (3) the split-half method.

The test-retest method of reliability is often used in attitude measurement, as it indicates the scale's coefficient of stability; an "estimate of how stable the results are over a given time period" (Adams & Schvaneveldt, 1985, p. 87). Test-retest reliability is determined by how closely the scores of the instrument correlate with a later, readministration of the same scale.

The equivalent-forms method is a test that reveals a scale's coefficient of equivalence. This method is often used to test the reliability of attitude measures. Testing equivalent-forms involves the construction of two instruments that measure the same construct, with items on the two forms worded in a slightly different way or arranged in a different order. The instruments are then administered to a group, and tested to reveal the equivalence of items from the two

Table 2-2. Types of Reliability

Type	Research Questions Addressed
Test-retest	Does an individual respond to an assessment device in the same general way when the test is administered twice?
Equivalent forms method	When two forms, which are equivalent in their degree of validity, are given to the same individual, is there a strong convergence as to how that person responds?
Split-half method	Are the scores on one-half of the test similar to those obtained on the remaining half?

Source: Adams, G. R., & Schvaneveldt, J. D. (1985). *Understanding research methods.* New York: Longman.

forms. A high coefficient of equivalence indicates that "both research measures are assessing similar content and, therefore, should be considered reliable samples of the subject matter being sampled" (Adams & Schvaneveldt, 1985, p. 88). The coefficient of equivalence, or correlation coefficient, is a statistical index of the degree of relationship between two variables. Values of correlation coefficients range from -1.00 through zero to +1.00. A correlation coefficient of 0.00 indicates no relationship between the variables.

For a scale with more than two levels, such as an attitude measure employing a Likert-type scale, internal consistency is often cited as evidence of the instrument's reliability. The result of this type of reliability is reported as a correlation coefficient which "provides an estimation of the degree to which the

two halves are equivalent" (Adams & Schvaneveldt, 1985, p. 88). The split-half method for testing reliability reveals the coefficient of internal consistency.

For the split-half test, the scale items are split into two halves in order to test individual items for their degree of correspondence. This method entails arbitrarily splitting the scale into two halves using either: (1) top-bottom reliability, or (2) odd-even reliability. Top-bottom reliability involves testing items from the top half of the scale grouped against those from the bottom half. Odd-even reliability is performed by taking the odd numbered items in the scale grouped against the even numbered items. With either test, scores for each group of items are determined by summing the values of the items contain in that particular group. A correlation coefficient is used to estimate the strength of the relationship between the two groups of items. The split-half method for testing reliability identifies the relationship between the scores of the two subgroups. The correlation coefficient indicates to what degree the subgroups of the scale are equivalent with each other. If the there is a high coefficient value, the scale items are believed to be consistent in measuring the same concept.

Instrument Design

Attention to the physical aspects of instrument design, such as question order, length of questionnaire, question format, and questionnaire layout has been shown to increase response rates (Rossi, Wright, & Anderson, 1983). These characteristics are examined in greater detail in this section of the discussion on measures of attitudes.

Order of Questions

The order of questions is an important consideration in questionnaire design. Many authors advise the researcher to begin a questionnaire with broad questions about the topic and then lead to more specific questions (Wimmer & Dominick, 1994; Adams & Schvaneveldt, 1985). Funneling, or ordering items from general to specific, in this way will provide a broad context of the subject to the respondent first, promoting thoughtful consideration given to the latter specific questions.

It is suggested that questions on a particular subject be clustered within a group. Within groups, questions should flow in a consecutive and chronological order (Rossi, Wright, & Anderson, 1983). Transitions between sections of the questionnaire should be logically placed, and clearly indicated.

Sections should be ordered in such a way that they do not influence responses in subsequent sections. In some cases, a section of questions might have a tendency to "clue" the respondent to a socially desired response or toward the intent of the study. Furthermore, some respondents will refuse to continue, or decline to answer items of a personal nature if they feel intimidated or embarrassed by such questions early in the survey. It is recommended that demographic questions and other sensitive items be placed at the end of a questionnaire.

Questionnaire Length

The length of a questionnaire is held to be directly related to its rate of completion. Long questionnaires are much more likely to elicit incomplete

answers due to the demands of the respondents' time. Wimmer and Dominick (1994) state that long questionnaires result in "fatigue, respondent mortality, and low completion rates" (Wimmer & Dominick, 1994, p. 120). The appropriate length is determined by factors such as (1) purpose of the study, (2) type of problem investigated, (3) type and complexity of the questions, and (4) setting of the testing situation (Wimmer & Dominick, 1994). Questionnaires that are reasonable in length will result in higher rates of completion.

Physical Design and Layout

Attention to the physical design and layout of questionnaires has been shown to increase response rates. Adams and Schvaneveldt (1985) report that surveys that are designed to look professional, personalized, and physically attractive will have a positive impact on response rate. These authors advise researchers to pay particular attention to the size of print, which should facilitate easy and accurate viewing; and visual clarity and spacing between items help promote accuracy in the placement of respondents' answers.

Computer Attitude Measures

As indicated in the literature, computer attitude is believed to influence both the acceptance of computers, as well as their subsequent use. In order to assess the attitude of preservice and inservice teachers toward the use of computers in education, a variety of computer attitude scales have been developed. Five of the most popular computer attitude scales are addressed in the

following section. This section is followed by a review of scales designed to measure an individual's attitude toward Internet use.

Computer Attitude Scales

One of the primary instruments designed to study attitude towards computers is the Minnesota Computer Literacy and Awareness Assessment Instrument (MCLAA). This scale is comprised of twenty items presented in a Likert-type format, and is designed to measure attitudes toward computers. Many of the items in the MCLAA have been adapted for other computer measures in the years since its introduction (Woodrow, 1991). Some of the most popular instruments today are the Computer Attitude Scale (CAS) by Gressard and Loyd (1986); the Computer Use Questionnaire by Griswold (1983); the Attitude Towards Computers Scale by Reece and Gable (1982); and the Computer Survey by Stevens (1982).

Internet Attitude Scales

A review of the literature failed to uncover an appropriate scale for measuring attitude toward the use of the Internet. Finlay and Finlay (1996) measured librarians' attitudes toward the Internet with an eleven-point bipolar scale anchored with "dislike very much"/"like very much," "very good"/"very bad," and dislike using"/"like using." They report reliability in the form of internal consistency on the final data set at .916.

Summary of Attitude Research

Attitude and attitude measures are an important part of the research in computer use in teaching and learning. An examination of the literature in the field of instructional technology revealed that attitude towards the use of computers has been the subject of many research studies. In respect to determinant characteristics, the results indicate that there is no difference between male and females in their attitude towards computers. However, there seems to be a strong relationship between positive computer attitudes and (1) computer knowledge and experience in all populations, (2) computer coursework in the preservice teacher population, and (3) technology training in the teacher population. There also is evidence from the field of consumer studies that increased attitude towards a product is related to increased product use.

It is agreed by most researchers that attitudes toward computers in educational environments must continuously be measured. Therefore, effective measures of attitudes are necessary. The development of attitude measures should utilize general test construction techniques. For instance, attitude measures should be valid, reliable, replicable; and simple to administer, explain, and understand. The five computer attitude scales mentioned in this paper exhibit the qualities of a well designed instrument, and are held to be valid and reliable measures of a general attitude toward computers and their use. Likewise, a instrument for the measure of attitudes toward the use of the Internet should be a valid and reliable scale.

Research on Innovativeness

The discussion of innovativeness in this chapter will follow a similar course as the treatment of attitudes. This section will first address the definition of innovativeness and describe the importance of the innovator in the research tradition. This is followed by a review of research on innovativeness pertinent to the study. Characteristics related to innovativeness are reviewed; these include demographic variables, social and personality characteristics, attitudinal characteristics, and the effects of knowledge and experience of the innovation on the adoption process. The innovativeness section of this chapter concludes with a summary account of scales designed to measure innovativeness.

Definition of Innovativeness

Innovativeness is the degree to which an individual is relatively earlier in adopting an innovation in relation to others in the social system (Hurt, Joseph, & Cook, 1977). The concept of an individual having the trait of innovativeness comes from the literature of diffusion research, outlined in the first chapter of this dissertation.

The body of research in the diffusion of innovations spans many disciplines and offers a framework for understanding the flow of information, ideas, and products. Table 2-3 illustrates some of the typical kinds of studies and major types of finding from four disciplines that have contributed to diffusion research.

Table 2-3. Comparison of Four Diffusion Research Traditions

Discipline	Typical Innovations Studied	Major Types of Findings
Education	Teaching and learning innovations (new math, cooperative learning, authentic assessment)	S-shaped adopter distribution; characteristics of adopters
Marketing	New consumer products (clothing fashions, computers, automobiles)	Characteristics of adopter categories; opinion leadership in diffusion
Public Health	Medical and health ideas (drugs, vaccinations, disease prevention)	Opinion leaders in diffusion; characteristics of adopter categories; communication channels
Rural Sociology	Agricultural ideas (hybrid seeds, pesticides, fertilizers)	S-shaped adopter distribution; characteristics of adopter categories; opinion leadership in diffusion

Adapted from: Rogers, E. M. (1995). *Diffusion of innovations,* fourth edition. New York: The Free Press.

Importance of the Innovator

Innovators are experimentalists who latch onto new ideas as soon as they appear. An innovator's interest lies primarily in the innovation itself, rather than with its application to significant problems (Geoghegan, 1994). The importance of research regarding the innovator in the diffusion tradition stems primarily from the following: (1) innovators account for initial levels of adoption, (2) innovators influence later adopters, and (3) innovators influence the market for new products (Robertson, 1971). The innovators' primary importance, then, is related to the speed of adoption of new ideas.

In respect to this importance on the rate of innovation adoption, many of the studies which focus on the role of innovators come from fields such as consumer affairs, marketing, and advertising. The implications of innovator importance for these studies are, therefore, related to how quickly and efficiently innovators are converted into product users (Robertson, 1971).

Innovator Characteristics

The innovator is the most thoroughly researched of all the adopter categories. This is the individual within a social system who is first to adopt a new idea or practice. Between research disciplines, innovator characteristics share similarities as well as some minor differences. For instance, in rural sociology this group is defined as the first 2.5 percent of total adopters, while in marketing studies percentages of innovators range as high as 10 percent and 33 percent (Robertson, 1971) have been reported. It should be mentioned that important

innovator characteristics in one discipline may differ from the characteristics found to be significant in another discipline.

In most disciplines, the common characteristic used to define innovators is "venturesomeness" (Rogers, 1995). Moreover, it is often cited that this group of early adopters seeks out new products often before general release, since "they desire the hazardous, the rash, the risky and the avant-garde" (Rogers & Stanfield, 1968). There are three qualifications in the diffusion literature that are commonly related to innovativeness: (1) a variety of demographic characteristics, (2) social characteristics, and (3) personality characteristics. In attempt to bridge the gap between innovativeness, experience, and attitude, this study will also investigate a fourth characteristics of innovativeness research: (4) attitudinal characteristics. Each of these qualifications is discussed in further detail in the subsequent sections. The first three sections will draw heavily on summary findings of diffusion research in consumer studies (e.g., Roger, 1995; Robertson, 1971; Turnbull & Meenaghan, 1980; Zaltman & Stiff, 1973).

Demographic Characteristics

Income, education, and age are the three demographic characteristics most often cited as factors related to innovativeness. In the thirteen studies cited by Robertson (1971) where innovators' income is taken into account, nine show higher income level to be associated with higher levels of innovativeness, whereas four show a lack of relationship. However, it is believed that the relationship between income and innovation is not necessarily linear. Cancian (1967) indicates that a curvilinear relationship between these two variables is to be expected, since middle-income individuals are less likely to take risks than those

individuals on either end of the income scale. His theory of innovator income is known as the "Cancian Dip", the "dip" refers to the otherwise linear relationship between socioeconomic status and innovativeness. Rogers (1995) puts forth the concept of "privilege" in his discussion of innovativeness and income. He holds that privilege, the financial standing relative to other community members, and social status are more important prerequisite for innovativeness than income alone.

Age and education are often cited as being positively related to innovativeness. Webster (1968) believes that a higher level of education leads to an individual's better use of information, and to an increase in one's tolerance for risk taking. Robertson's (1971) analysis of innovative research reveals that a majority of the studies he examined "show higher education level to coincide with greater new product adoption" (Robertson, 1971, p. 104). Age, he continues, tends to show a lack of relationship to innovativeness. This lack of relationship between age and innovativeness is echoed by Rogers (1995), who reports that a majority of the 228 relevant innovativeness studies indicate no relationship between these two variables.

Social Characteristics

The extent to which an individual participates either formally or informally with other community members is related to innovativeness (Robertson, 1971). The following social interaction characteristics have historically been shown to be positively related to innovativeness: early adopters (1) have more social participation, (2) have a higher degree of opinion leadership, (3) are more

cosmopolite, (4) have greater mass media communications channels, (5) deviate more from social system norms, (6) have more contact with change agents, and (7) have more interpersonal communications exposure than later adopters (Rogers, 1995; Turnbull & Meenaghan, 1980). The most influential of these characteristics are social participation, opinion leadership, and norms. These three considerations are examined further in this section.

The innovator has been shown to be higher on both informal social participation, which include friends and neighbors, and formal social participation, composed of organizational memberships (Rogers, 1995). An association between opinion leadership and innovativeness is evident in the majority of studies cited by Robertson (1971). This is a critical relationship, since the rate of adoption in diffusion theory is built upon the influential role of the innovator.

In consumer studies, innovators have historically reflected a more favorable attitude toward purchasing new items. This attitude is believed to be an expression of how the individual consumer perceives the relevant standards regarding innovative behavior within his social system. There is a tendency for both innovators and noninnovators to reflect some cautiousness toward new purchases; however, noninnovators reflect considerably greater caution (Robertson, 1971).

Research on the adoption and diffusion of a telecommunications network for education (Hamilton & Thompson, 1992) corroborate the findings of earlier studies related to social characteristics of early adopters. It was discovered that, in general, the characteristics of teachers who are early adopters agreed with previous findings in respect to early adopters' social status, social participation,

cosmopolitan outlook, mass media use, personal communication, and degree of innovation information seeking.

Personality Characteristics

There are a number of personality characteristics identified in diffusion research that are positively associated with innovativeness: early adopters (1) are more venturesome, (2) have greater empathy, (3) are believed to be less dogmatic, (4) are believed to be more intelligent, (5) have higher aspirations in regard to education and occupations, and (6) have a more favorable attitude toward science and technology than later adopters (Rogers, 1995; Robertson, 1971). The most significant of these characteristics, from the standpoint of this study, are venturesomeness and attitude toward technology. An overview of venturesomeness and variables related to personality inventories are summarized in this section. The concept of innovativeness related to attitude toward technology will be addressed in the next section of this chapter.

Venturesomeness is a term which refers to one's "willingness to take risks in respect to the adoption of new idea" (Robertson, 1971). This concept relates to Rogers' (1995) statement of innovators, desire the hazardous, rash, risky and the avant-garde (Rogers & Stanfield, 1968). Venturesomeness in diffusion research has been found in numerous studies to be related to high innovativeness (Robertson, 1971).

Personality measures as a predictor of innovativeness do not produce particularly meaningful results. In the administration of personality inventories such as the Thurstone Temperament Schedule and the California Personality

Inventory, there is a lack of consensus with respect to demonstrating positive relationships. Robertson (1971) summarized results of such tests, indicating that (1) the concept of self-confidence has not been found to be conclusively associated with innovativeness, (2) early buyers are higher in the variables of "achievement/competitiveness" and "change orientation" than later buyers or nonbuyers, and (3) for some consumer products, innovators were found to be more optimistic.

In respect to personality characteristics and Internet use, no studies were found. However, a study (Moore, 1995) of the characteristics of early adopters of telemedicine, from research on telecommunications and public health, confirms many of the generalizations of personality variables of consumer research. In addition, the study suggests that earlier adopters of telemedicine may be more emotionally mature and better able to cope with stressful situations than the population as a whole. This study may prove to be significant to the study of telecommunications and the Internet, because initial users of telecommunications in medicine might share similar personality characteristics as the early adopters of telecommunication in education.

Attitudinal Characteristics

One area of innovator research that provides conclusive results across many disciplines is the relationship between innovativeness and attitude toward the innovation (Finlay & Finlay, 1996; Huang, 1993; Rogers, 1995; Shaw & Wright, 1967). Research in attitude towards new media technology in journalism students and educators found that those of the personality type "Champions of

Change" are more likely to become the early adopters of new media technology. These individuals were found to demonstrate higher positive attitudes toward new media, viewing technology primarily as a tool empowering users (Craig, et al., 1995).

The two studies related to attitude and innovativeness that most directly relate to this dissertation are Huang (1993) and Finlay and Finlay (1996). Huang's (1993) study of arts education faculty at teachers colleges in Taiwan reveals that innovators in this population had higher attitudes toward the innovation than later adopters. He reports conclusively that "arts education faculty who were innovators demonstrated more favorable attitudes toward the use of instructional media than noninnovators" (Huang, 1993, p. 67).

Finlay and Finlay (1996) conducted a study of innovativeness related to both attitude and use of the Internet within a population of librarians, employed at libraries in Canada. They report that the primary effect of innovativeness, related to overall positive attitudes towards the Internet, was significant. In addition, they hold that being innovative, or open to new ideas, "positively predisposes librarians to an innovation such as Internet use" (Finlay & Finlay, 1996, p. 73).

Measures of Innovativeness

Hurt, Joseph, and Cook (1977) hold that self-report measures of innovativeness are not limited to a specific innovation, as they are capable of measuring innovativeness across a variety of situations. In addition to self-report measures, diffusion studies have employed the use of sociometric methods, informants'

ratings, and observation. Table 2-4 compares the four most common types of research methods deployed in diffusion research on opinion leadership.

Self-Report Measurements of Innovativeness

There are four self-report measurements of innovativeness identified in the literature: (1) the Innovativeness Scale, (2) the Open Process Scale, (3) the Goldsmith and Hoflacker Innovativeness Scale, and (4) the Kirton Adoption of Innovative Behavior scale. A general description along with the measured construct of each of these scales is discussed in this section.

In a convergent validity study (Goldsmith, 1986) of three of these four scales, it was determined that they each measure related but not identical constructs. The Innovativeness Scale (Hurt, Joseph, & Cook, 1977) and the Open Processing Scale (Leavitt and Walton, 1975) are the most similar, in that they both measure the willingness to try new ideas. Goldsmith (1986) reports reliability coefficients between the two scales to be high and significant at .81. The Goldsmith and Hoflacker Innovativeness Scale (Flynn and Goldsmith, 1993) differs from these first two scales, as it is designed to measure domain-specific innovativeness. This refers to innovative attitudes and behaviors within a certain domain, described by the authors in the context of consumer behavior. Convergent validity for this scale has not been reported, in respect to the other measures of innovativeness mentioned here. The Kirton Adoption of Innovative Behavior Scale (Kirton, 1976) measures different styles of creativity and problem solving. The author contends that innovators reorganize the structure of problem solving, leading to more abrupt solutions. Coefficients, with respect to

Table 2-4. Four Methods of Measuring Opinion Leadership

Method	Description	Questions Asked
Sociometric method	Ask system members to whom they refer for advise and information about an idea.	Who is your leader?
Informants' ratings	Subjectively selected key informants in a system are asked to designate opinion leaders.	Who are the leaders in this system?
Self-report method	Ask respondents to rate statements related to how he/she regards him/herself to be an opinion leader.	Are you a leader in this system?
Observation	Identify and record communication network links as they occur.	None

Adapted from: Rogers, E. M. (1995). *Diffusion of innovations,* fourth edition. New York: The Free Press.

convergent validity for this scale, are a moderately high .72 and .63 with the Innovativeness Scale and Open Processing Scale, respectively.

The Innovativeness Scale (Hurt, Joseph, & Cook, 1977) most closely measures the generalized personality trait, "willingness to change", based upon the concept of innovativeness in the research of Rogers (1995). The use of the Innovativeness Scale makes it possible to identify types of adopters, relevant to the degree of willingness-to-change, prior to the introduction of a new idea. This instrument is general enough to be applied to a variety of studies.

Summary of Innovativeness Research

In this chapter, innovativeness research was examined in three sections: (1) a definition of innovativeness and description of the importance of the innovator in the research tradition; (2) a review of the literature in innovativeness studies related to the demographic, social, personality, and attitudinal characteristics; and (3) a summary of methods use to measure innovativeness.

The theoretical perspective of diffusion is addressed by Everett Rogers in *Diffusion of Innovations* (1995). He identifies the diffusion process as that by which an innovation is communicated through certain channels, over time, and among members of a social system. Innovativeness can be defined as the degree to which an individual is relatively earlier in adopting an innovation in relation to others in the social system. Innovators are experimentalists who latch onto new ideas as soon as they appear.

The innovators' importance in research is related to the speed of adoption of new ideas. The review of related research in the innovativeness tradition

indicates a positive relationship between innovativeness and the following: (1) the demographic characteristics of income and education; (2) the social characteristics of social participation, opinion leadership, and norms; (3) the personality characteristics of venturesomeness and attitude toward technology; and (4) the relationship between innovativeness and attitude toward the innovation.

There exist four primary self-report measures for determining an individual's level of innovativeness: (1) the Innovativeness Scale, (2) the Open Process Scale, (3) the Goldsmith and Hoflacker Innovativeness Scale, and (4) the Kirton Adoption of Innovative Behavior scale. The Innovativeness Scale most closely measures the generalized personality trait, "willingness to change". Therefore, use of this scale makes it possible to identify types of adopters, based upon the degree of this concept, prior to the introduction of a new idea. In addition, this instrument is general enough to be applied to a variety of studies, and has high validity and reliability.

CHAPTER III

METHODS

This study was designed to examine the relationship between teachers' innovativeness, attitude toward the use of the Internet, and Internet use. This chapter outlines the methodological constructs of the research design. Attention is given to characteristics of the population, instrument development, instrument testing, instrument design, procedures for data collection, procedures for data preparation, procedures for data analysis, and research hypotheses.

Population

A population refers to a group of people, variables, ideas, or other phenomena sharing common characteristics. One of the principal goals of social science research is to describe the characteristics of a population, yet, in most studies it is not feasible to investigate an entire population. Researchers generally examine a portion of the population, called a sample. Wimmer and Dominick (1994) define a sample as "a subset of the population that is taken to be representative of the entire population" (Wimmer & Dominick, 1994, p. 64). A properly selected sample allows researchers to make accurate generalization about the population, since the characteristics of such a sample reflect the characteristics of the population as a whole.

The population for this study was the full-time teaching faculty of a school system in Tennessee. The name of the school system is withheld for this

study to protect the anonymity of the participants, it will be referred to as the "Springfield School System". At the time of this study the school system was composed of one elementary school, one middle school, and one high school. The total number of faculty for the 1997-1998 school year was approximately 100. These teachers were responsible for the education of approximately 1,475 students. Personnel in the school system excluded from the sample were administrators, teaching assistants, substitute teachers, and support staff.

This school system was chosen as the population for this study for several reasons. The lack of uniform Internet access within school buildings and throughout school systems has been an obstacle to measuring such variables as attitudes, usage measures, personality types, and demographics in relation to the Internet. The Springfield School System was unique in that it was the only major school system in the region, at the time of this study, where dedicated Internet access existed in each school building.

Other determinants of the population were based on the following: (1) Internet inservice training on basic use of electronic mail and the World Wide Web had been attended by a majority of Springfield School System faculty; (2) all faculty had previously been provided e-mail accounts; (3) a new computer lab, capable of Internet use, was built for faculty use beginning with the 1997-1998 school year; (5) an existing lab, comprised of 24 computers, was updated for faculty and student Internet use; and (6) 235 of the 326 classroom-based computers in the Springfield School System were connected to the Internet.

The primary technology objectives for the 1997-1998 school year in the system called for (1) continued training for the faculty on Internet use, and (2)

the connection of every capable computer in the school system to the Internet. Faculty technology training for the 1997-1998 school year included sessions on instructional use of e-mail, use of the World Wide Web for educators, and development of World Wide Web resources.

Instrumentation

A self-report questionnaire was developed as the research instrument to be employed in this study. A questionnaire is a "list or grouping of written questions which a respondent answers" (Adams and Schvaneveldt, 1985, p. 202). The purpose of a good questionnaire is (1) to meet the objectives of the research, (2) provide complete and accurate information, and (3) to provide this information within the limits of available time and resources (Rossi, Wright, & Anderson, 1983).

Self-report questionnaires have been used extensively in research on computer attitudes in education. In addition, in consumer studies research there are a number of questionnaires available to measure the innovativeness of an individual. Studies (e.g., Hurt, Joseph, & Cook, 1977; Jorde, 1985; Kirton, 1976) indicate that the way in which individuals view themselves with respect to the personality dimension of innovativeness provides an accurate predictor of innovation behavior.

Miller (1991) contends that once an appropriate scale for a construct is found, the available scale should be used if it has the qualities of validity, reliability, and utility; since "with such a scale, comparative and accumulative research is possible" (Miller, 1991, p. 174). During the development of the

questionnaire for this study, a thorough review of the literature was made to determine if appropriate scales were available to measure the dependent and independent variables. The following section provides an overview of the development and design of the instrument for this study.

Instrument Development

The instrument for this study was a self-report questionnaire composed of five sections: (1) a cover letter explaining the nature of the research, the estimated time necessary to complete the survey, the voluntary nature of participation, and a statement indicating informed consent; (2) a scale developed by Hurt, Joseph, and Cook (1977) for the measurement of innovativeness; (3) a scale developed by the researcher to measure participants' attitude toward the use of the Internet; (4) a section of questions regarding the participants' history, frequency, variety, and location of Internet use; and (5) a section of questions related to gathering demographic data about the participants. The complete instrument is presented in Appendix A.

Detailed information about the development and testing of the instrument is presented in the following sections.

Innovativeness Scale

Hurt, Joseph, and Cook (1977) developed the Innovativeness Scale as a reliable and valid self-report scale for measuring the degree to which an individual is relatively earlier in adopting an innovation in relation to others in the social system. This scale is composed of twelve positively and eight negatively

phrased items presented in a seven-point Likert-type response format. The Innovativeness Scale is designed to measure the normally distributed personality trait, "willingness to change", which contributes to the adoption or rejection of new ideas (Goldsmith, 1986).

In developing the scale, the authors generated a series of statements to coincide with the five categories of innovativeness expressed by Rogers and Shoemaker (1971). The *Innovativeness Scale* is presented in Appendix B. Sample items for each personality type include: *Innovator* - "I consider myself adventuresome in relation to people like me"; *Early Adopter* - "I have a position of responsibility in at least one of the groups I belong to"; *Early Majority* - "I make decisions deliberately and methodically"; *Late Majority* - "I like stability and consistency"; and *Laggard* - "I am suspicious of new inventions and new ways of thinking" (Hurt, Joseph, & Cook, 1977). The scale was tested for reliability and validity on samples of 231 college students and 431 public school teachers.

In testing the reliability of the Innovativeness Scale, the authors report a high coefficient of internal consistency of .94 using the Nunnally technique for split-half comparisons (Hurt, Joseph, and Cook, 1977). In testing construct validity for the Innovativeness Scale, the authors tested the correlated distribution of responses of their study with the distribution of innovator types identified by Rogers and Shoemaker (1971). Hurt, Joseph, and Cook (1977) found that innovators comprise 1.5% of the population; early adopters make up 13.5%; early majority are 34.91%; late majority are also 34.91%; and laggards, 15.63%. These percentages do not differ significantly from those of adopter types defined by Rogers and Shoemaker (innovators, 2.5%; early adopters, 13.5%; early major-

ity, 34%; late majority, 34%; and laggards, 16%). Criterion-related validity of the Innovativeness Scale has been tested to reveal significant validity coefficients. In a study of validity between four established innovativeness scales, coefficients for the Innovativeness Scale range from .50 to .75. This indicates that the Innovativeness Scale measures the same personality trait as other scales of innovativeness (Goldsmith, 1986).

Internet Attitude Scale

A review of the literature failed to uncover an appropriate scale for measuring attitude toward the use of the Internet. For this reason, the researcher developed a scale for this construct. The developed instrument was named the Internet Attitude Scale. It is a twelve-item scale designed to measure the cognitive, behavioral, and affective domains of attitude. The scale is presented in Appendix C.

The cognitive realm of attitude is one's beliefs, knowledge, and evaluation of an object (see Appendix C). The cognitive domain of the Internet Attitude Scale consists of five statements, such as "I can see the importance of using the Internet in my life" and "Using the Internet will probably be an important part of my life." Cognitive statements are measured on a seven-point Likert-type scale with response options ranging from "strongly agree" to "strongly disagree."

The behavioral, or action-tendency, domain of attitude is defined as an "individual's readiness to behave overtly toward the object" (Robertson, 1971). The behavioral domain of the Internet Attitude Scale is represented by three statements and is based on a seven-point Likert-type scale with response options

ranging from "strongly agree" to "strongly disagree" (see Appendix C). Examples of behavioral attitude questions are "I would like to spend more time using the Internet" and "I look forward to using the Internet."

The affective, or feeling, domain of attitude is an individual's emotional range related to an object. Statements in the Internet Attitude Scale related to the affective domain are presented in a semantic differential scale (see Appendix C). The semantic differential format measures an individual orientation to an object or concept and has been widely utilized in measures of affective attitudes (Miller, 1991). There are four items in the affective component of the scale, represented by word pairs such as "Excited/Unexcited" and "Comfortable/Uncomfortable."

The development of content validity for the Internet Attitude Scale followed the review of a wide range of attitude measures in the literature. The objective of this search was to determine which items are most relevant to the research objective. From this review the researcher generated an initial pool of 30 item statements (10 items for cognitive, 10 items for behavioral, and 10 items for affective) to address each dimension of Internet attitude. As suggested by Rossi, Wright, and Anderson (1983), the help of friends and colleagues was solicited at this point to suggest new ideas and help clarify the wording of the initial group of statements.

The initial pool of 30 item statements was presented via the World Wide Web to an international group of students, researchers, and practitioners in a variety of fields related to the research. The researcher solicited comments via direct e-mail, postings to a variety of newsgroups (e.g., alt.psychology, alt.internet, alt.education.research), posts to educational technology-related

listservs, and via links from related World Wide Web sites. The objective of this content review was to assess and suggest changes to each item in the scale, and to rate the most appropriate items in each section of the scale.

As a result of the content review, the Internet Attitude Scale was modified to include a total of twelve statements: five items related to the cognitive domain, three items for behavioral, and four items in respect to the affective domain of attitude. For a summary of scores related to the content review, see Appendix D.

Reliability of the Internet Attitude Scale was determined with a pretest of the scale, which included twenty-six of the original thirty item statements. The sample for the pretest were 140 students enrolled in six sections of the Introduction to Instructional Technology course at the University of Tennessee, Knoxville, in October 1997. The Internet Attitude Scale is designed to measure an individual's cognitive, behavioral, and affective domains of attitude toward the use of the Internet – regardless of prior computer or Internet experience, age, gender, or other demographic variables.

The scale was given to the subjects to complete, along with a cover letter. This letter explained the nature of the research, the estimated time necessary to complete the survey, the voluntary nature of participation, and a statement indicating informed consent. The survey instruments were completed and returned by 131 participants. Responses were entered into the Statistical Program for Social Science (SPSS) for scale reliability testing.

The complete twenty-six item scale was tested for reliability using the Guttman split-half technique. This method reveals the coefficient of internal consis-

tency. The scale is split into two halves in order to test individual items for their degree of correspondence. A correlation coefficient is used to estimate the strength of the relationship between the two halves. The twenty-six item scale revealed a high coefficient of .81, test scores are presented in Table G-1, Appendix G. The correlation coefficient of the twelve item scale was .85, test scores for this version of the scale are presented in Table G-2, Appendix G. Based upon the high coefficient of internal consistency, the researcher decided to use the twelve item version of the scale for this study.

Internet Use

A self-report measure of Internet experience and use was developed by the researcher for this study based on studies in the literature regarding computer and Internet experience (e.g., Anderson, 1995; Finlay & Finlay, 1996; Wheeler, 1996). This self-report measure is presented in Appendix E. Usage measures are divided into four domains: (1) history of Internet use, (2) frequency of Internet use, (3) location of Internet use, and (4) variety of Internet services used.

History of Internet use is related to the length of time a participant has been using the Internet (see Appendix E). The Internet history question included in this scale was: "How long have you been using the Internet?" (0 - 6 months, 7 - 12 months, 13 - 35 months, 36 + months).

Questions regarding frequency of Internet use pertain to the number of times the Internet is used during a given period of time (see Appendix E). The Internet frequency question included in this scale was: "Approximately how many hours per week do you spend using the Internet?" (less than 1 hour, more

than 1 but less than 4 hours, more than 4 but less than 10 hours, 10 hours or more).

Location questions seek to determine where the participants have access to the Internet (see Appendix E). Questions related to location included, "I have access to the Internet..." and "From which of the following locations do you most frequently use the Internet?" Participants are instructed to mark all locations where they have access to the Internet (home, college or university campus, work, public library, other, I have no access to the Internet).

Variety is an indication of breadth of use measured by the number of Internet services used by participants (Finlay & Finlay, 1996). The question on this instrument regarding use of Internet services was: "I have used the following Internet services..." (see Appendix E). Participants are prompted to mark all of the Internet services that they have used (World Wide Web, Newsgroups, E-mail, Gopher, FTP, IRC/Chat, other).

Demographic Data

Demographic factors such as age, gender, income, and level of education are often related in the literature to attitude and personality differences. In order to investigate possible relationships between these variables, a section of demographic information comprised of six questions was included: (1) Are you male or female? (2) What grade level do you teach? (3) What subject area do you teach? (4) What is the highest level of formal education you have completed? (5) What is your age? and (6) What is your total household income before taxes for the current calendar year? (see Appendix F).

Instrument Design

Numerous authors (e.g., Lundberg, 1942; Rossi, Wright, & Anderson, 1983) report that attention to the physical aspects of instrument design; such as question order, length of questionnaire, question format, and questionnaire layout, has been shown to increase response rates. This study made use of these findings, as outlined in the following sections.

Order of Questions

In respect to the criteria identified in the research of questionnaire design regarding the order of questions, the instrument for this study was arranged as follows: (1) the Innovativeness Scale; (2) the Internet Attitude Scale developed by the researcher; (3) Internet use questions; and (4) demographic questions.

This question order is in accordance with Finlay and Finlay (1996), who believe that attitude measures that follow usage measures may not reflect the participants' true attitudes. To help solicit genuine attitude questions, therefore, the questionnaire for this study positioned the Internet Attitude Scale before the section of Internet use questions.

Questionnaire Length

Research on questionnaire length reports that long questionnaires are much more likely to elicit incomplete answers due to the demands of the respondents' time (Wimmer & Dominick, 1994). Questionnaires that are reasonable in length will result in higher rates of completion. The survey questionnaire for this

study was estimated to take no more than 10 minutes to complete. This was assumed to be within the acceptable timeframe for this population.

Physical Design and Layout

Attention to the physical design and layout of questionnaires has been shown to increase response rates (Adams & Schvaneveldt, 1985). In order to incorporate recommendations on type and spacing from the research on physical layout, the questionnaire for this study was designed in the professional desktop publishing program, and the original copy was printed on a high quality laser printer.

Human Subjects Review

Voluntary consent is the basis for the ethical code of research involving human subjects. This code provides specific details on how to conduct ethical research, with the following rights granted to subjects: capacity to consent, freedom from coercion, comprehension of the risks and benefits involved, minimization of risk and harm, a favorable risk/benefit ratio, qualified investigators using appropriate research designs, and freedom for the subject to withdraw at any time (Medical School Institutional Review Board, 1996).

In this study, human subjects clearance was obtained by submitting a "Application for Review of Research Involving Human Subjects" to the Research Compliances Section of the Office of Research at The University of Tennessee, Knoxville, via the College of Education. In compliance with human subjects code, the survey questionnaire was administered to the population with

a cover letter outlining: (1) the nature of the research, (2) the estimated time necessary to complete the survey, (3) the voluntary nature of participation, (4) a statement indicating informed consent, and (5) methods to contact the researcher.

Data Collection

The Springfield School System superintendent was contacted and approved the request to conduct this study. The request was then sent to individual school principals for their approval. When approval was granted from all administrators, the researcher distributed the instrument to the faculty members of the Springfield School System.

Data Preparation

The completed survey instruments were collected and responses entered into Microsoft™ Excel. This file was imported into the Statistical Program for Social Science (SPSS) version 7.5, for analysis.

Data Analysis

Data analysis involves an examination of the data and testing of hypotheses. SPSS version 7.5 was used for the descriptive statistics, hypotheses testing, and examination of additional significant findings. Analysis of the statistical procedures used in hypotheses testing is presented in Table 3-1.

Table 3-1. Data Analysis for Hypotheses Testing

	Independent Variable	Dependent Variable	Test
H1	Innovativeness	Internet Attitude	ANOVA
H2a	Innovativeness	History of Internet Use	ANOVA
H2b	Innovativeness	Frequency of Internet Use	ANOVA
H2c	Innovativeness	Variety of Internet Use	ANOVA
H3a	Internet Attitude	History of Internet Use	Correlation
H3b	Internet Attitude	Frequency of Internet Use	Correlation
H3c	Internet Attitude	Variety of Internet Use	Correlation
H4a	Age	Innovativeness	ANOVA
H4b	Education	Innovativeness	ANOVA
H4c	Income	Innovativeness	ANOVA

Research Hypotheses

Researchers develop hypotheses to generate predictions that can be tested empirically. A hypothesis is "a statement about the relationship between two or more variables which can be empirically tested" (Reid, 1987, p. 44). It is important to understand that scientific theories and hypotheses can never be "proven true" but can be supported or not supported by currently available data.

Hypothesis 1: Innovativeness and Internet Attitude

Research in the literature indicates that innovativeness is related to positive attitudes towards new experiences and novel stimuli (Leavitt & Walton, 1975), instructional media (Huang, 1994), new technology (Craig et al., 1995), and the Internet (Finlay & Finlay, 1996); therefore, the following is hypothesized:

H1 Teachers who are innovative adopters are hypothesized to have higher positive attitudes toward the use of the Internet than other adopter types.

Hypothesis 2: Innovativeness and Internet Use

Innovators are often characterized as venturesome, a term which refers to their "willingness to take risks in respect to the adoption of new idea" (Robertson, 1971). In consumer studies research, early adopters have been found to show a more favorable attitude toward science and technology than later adopters (Rogers, 1995; Robertson, 1971). In educational technology, early adopters are characterized as those searching for breakthroughs in instructional methods enabled by new technology (Geoghegan, 1994); therefore, the following are hypothesized:

H2a Teachers who are innovative adopters are hypothesized to have a longer history of Internet use than other adopter types.

H2b Teachers who are innovative adopters are hypothesized to have a greater frequency of Internet use than other adopter types.

H2c Teachers who are innovative adopters are hypothesized to have a greater variety of Internet use than other adopter types.

Hypothesis 3: Internet Attitude and Internet Use

Studies show that as individuals have more computer experience in respect to a variety of software, they have less computer anxiety (McInerney et al., 1990; Reed et al., 1995). In addition, individuals who have experience with computer equipment and the use of computers have been found to have reduced

anxiety and increased positive attitudes towards computers (Kolehmainen, 1992). Therefore, the following are hypothesized:

H3a Teachers who have high positive attitudes toward the use of the Internet are hypothesized to have a longer history of Internet use.

H3b Teachers who have high positive attitudes toward the use of the Internet are hypothesized to have a greater frequency of Internet use.

H3c Teachers who have high positive attitudes toward the use of the Internet are hypothesized to have a greater variety of Internet use.

Hypothesis 4: Innovativeness and Demographic Variables

Age, income, and education are the demographic variables most often cited as factors related to innovativeness. In consumer studies cited by Robertson (1971) where an innovator's income is taken into account, the majority show higher income levels to be associated with higher levels of innovativeness. Additionally, Webster (1967) reports that a higher level of education leads to an individual's better use of information, and to an increase in one's tolerance for risk taking. Although the relationship between age and innovativeness is inconclusive, in some studies an increase in age is cited to have a negative correlation with innovativeness (Rogers, 1995). Therefore, the following are hypothesized:

H4a Teachers who possess a high level of formal education are hypothesized to be more innovative than other members of the population.

H4b Teachers who belong to a younger age group are hypothesized to be more innovative than other members of the population.

H4c Teachers who belong to a higher income group are hypothesized to be more innovative than other members of the population.

CHAPTER IV

RESULTS

This study examines the relationship between teachers' innovativeness, attitude toward the use of the Internet, and Internet use. Data was collected from the full-time teaching faculty of the Sprinfield School System in February 1998. Of the approximately one hundred teachers in the schools system, seventy-three completed and returned the survey instrument. Data were recorded and analyzed in the manner outlined in the previous chapter.

The presentation of data in this chapter begins with a report of the reliability of the instrument scales, based upon the final data set. This is followed by an extensive presentation of descriptive statistics, the testing of research hypotheses, an examination of other significant findings, and a summary of the research results.

Instrument Reliability Testing

Internal consistency is a measure of a scale's reliability to provide consistent results over time and for different occasions. As mentioned in the previous chapter, internal consistency for the Innovativeness Scale using the Nunnally technique for split-half comparisons was reported at .94 (Hurt, Joseph, & Cook; 1977). It was also previously reported that the internal consistency of the Internet Attitude Scale was determined by the researcher in a pretest to this study. In the

pretest, the coefficient for the Internet Attitude Scale was reported at .89 using the split-half technique.

The Guttman split-half comparison technique was used on the final data set for this study. This test resulted in a correlation coefficient of .96 for the Innovativeness Scale, and .89 for the Internet Attitude Scale. These numbers confirm the high reliability of both scales. The complete reliability analysis for the Innovativeness Scale and this data set can be found in Table G-3, Appendix G; and for the Internet Attitude Scale in Table G-4, Appendix G.

Descriptive Statistics

Descriptive statistics for frequency, central tendency, and dispersion measures are presented in this section. These measures relate to the following sections of the research instrument: (1) Innovativeness Scale, (2) Internet Attitude Scale, (3) Internet use variables, and (4) demographic variables.

Innovativeness Scale

The Innovativeness Scale was developed as a reliable and valid self-report scale for measuring the degree to which an individual is relatively earlier in adopting an innovation in relation to others in the social system (Hurt, Joseph, & Cook; 1977). It is composed of 12 positively and 8 negatively worded items presented in a seven-point Likert-type response format. Scores for the Innovativeness Scale are determined by summing items on the scale. Higher scores represent a higher level of innovativeness. The possible scale range is 120 points, with a minimum score of 20 and maximum of 140.

Innovativeness scores for this study ranged 111 points, from a minimum score of 29 to a maximum of 140. The mean innovativeness score was 108.81, with a median score of 114. The scale's mode was 100, with a standard deviation of 22.88 and variance of 523.30. Measures of central tendency and dispersion are presented in Table 4-1, and the complete frequency distribution for the Innovativeness Scale in this study can be found in Table I-1, Appendix I.

Table 4-1. The Innovativeness Scale Measures of Central Tendency

Mean	Median	Mode	Standard Deviation	Variance
108.81	114	100	22.88	523.30

Rogers (1995) identifies the top 16 percent of a population as innovators and early adopters. The bottom 16 percent of a population are classified as laggards, with the remaining 68 percent of the population representing the early and late majority of adopters. Based upon this model, scores for the Innovativeness scale were collapsed into three categories: (1) The top 16 percent of respondents in this study were identified as innovators, (2) the bottom 16 percent as laggards, and (3) the remaining respondents were identified as the majority. Frequency measures for these scores are presented in Table 4-2.

Table 4-2. Frequency Measures for Adopter Types

Adopter Type	Frequency	Percent	Cumulative Percent
Laggard	12	16.4	16.4
Majority	49	67.1	83.6
Innovator	12	16.4	100.0
TOTAL	73	100.0	

Internet Attitude Scale

The Internet Attitude Scale is designed to measure the affective, cognitive, and behavioral domains of attitude toward the use of the Internet. Scores for the Internet Attitude Scale are determined by summing items on the scale. The possible scale range is 72 points, with a minimum score of 12 and maximum of 84. Higher scores on this scale represent a higher positive attitude toward the use of the Internet.

Internet attitude scores for this study ranged 66 points, from a minimum score of 18 to a maximum of 84. The mean attitude score was 67.29, the median score was 70. The scale's mode was 84, with a standard deviation of 14.36 and variance of 206.12. Measures of central tendency and dispersion are presented in Table 4-3, and the complete frequency distribution for Internet attitude scores can be found in Table I-2, Appendix I.

Table 4-3. The Internet Attitude Scale Measures of Central Tendency and Dispersion

Mean	Median	Mode	Standard Deviation	Variance
67.29	70	84	14.36	206.12

Internet Use Variables

A self-report measure of Internet use was developed by the researcher for this study. Usage measures for this study are divided into five variables: (1) access to the Internet, (2) primary location of Internet use, (3) history of Internet

use, (4) frequency of Internet use, and (5) variety of Internet services used. Measures of central tendency and dispersion for all Internet use variables can be found in Table I-3, Appendix I.

Access to the Internet

Access to the Internet is a measure of the number of locations that a participant has access to the Internet. In this study, participants were instructed to indicate all locations where they have access to the Internet (home, work, public library, other, college or university campus, I have no access to the Internet). Frequency measures for cumulative access, representing the summation of Internet access locations, are reported in Table 4-4.

One respondent in this study reported no location for Internet access. The largest group (37.0 percent) reported having access to the Internet in two locations, and over 76 percent of respondents reported having access to the Internet in two or more locations. The mean number of Internet locations was 2.29, with a standard deviation of 1.02 and a variance of 1.04.

Table 4-4. Frequency Measures for Access to the Internet

Access Locations	Frequency	Percent	Cumulative Percent
No location	1	1.4	1.4
1 location	16	21.9	23.3
2 locations	27	37.0	60.3
3 locations	20	27.4	87.7
4 locations	8	11.0	98.6
5 locations	1	1.4	100.0
TOTAL	73	100.0	

Primary Location of Internet Use

In order to determine the primary location of Internet use, participants were instructed to mark only the one location where they most frequently use the Internet (home, work, public library, college or university campus, other, I have never used the Internet). Frequency measures for primary location of Internet use are reported in Table 4-5.

These frequency measures show that the largest group (54.8 percent) reported their workplace as being the primary location of Internet use, whereas twenty participants (27.4 percent) reported using the Internet most frequently from home. Work and home locations combined account for over 82 percent of primary Internet use locations. Three participants (4.1 percent) reported using the Internet primarily from a college or university campus, and one participant (1.4 percent) reported using the Internet primarily from her husband's office. Nine participants in this study (12.3 percent) responded that they have never used the Internet.

Table 4-5. Frequency Measures for Primary Location of Internet Use

Location of Use	Frequency	Percent	Cumulative Percent
Never Used	9	12.3	12.3
Home	20	27.4	39.7
Work	40	54.8	94.5
Library	0	0.0	94.5
College	3	4.1	98.6
Other	1	1.4	100.0
TOTAL	73	100.0	

History of Internet Use

History of Internet use is related to the length of time a participant has been using the Internet. For this variable, participants responded to the question: "How long have you been using the Internet?" (0-6 months, 7-12 months, 13-35 months, 36+ months). Frequency measures for history of Internet use are reported in Table 4-6.

Twelve participants (16.4 percent) reported using the Internet for six months or less. Those who have been using the Internet for twelve months or less make up 38.4 percent of this population. Twenty-three participants (31.5 percent) reported using the Internet for more than one year, yet less than three years (13-35 months). Sixteen (21.9 percent) subjects responded to a history of using the Internet between seven and twelve months. Those with the longest history of Internet use (36+ months) account for 17.8 percent of all respondents. Nine participants in this study (12.3 percent) responded that they have never used the Internet.

Table 4-6. Frequency Measures for History of Internet Use

History of Use	Frequency	Percent	Cumulative Percent
Never Used	9	12.3	12.3
0-6 months	12	16.4	28.7
7-12 months	16	21.9	50.6
13-35 months	23	31.5	82.1
36+ months	13	17.8	100.0
TOTAL	73	100.0	

Frequency of Internet Use

Frequency of Internet use pertains to the amount of time the Internet is used during a given period. The Internet frequency question included in this study was: "Approximately how many hours per week do you spend using the Internet?" (less than 1 hour, more than 1 but less than 4 hours, more than 4 but less than 10 hours, 10 hours or more). Measures for the frequency of Internet use are reported in Table 4-7.

Results of frequency of Internet use show that the largest group are those who reported using the Internet between one and four hours per week, they represent thirty-six participants (49.3 percent) in the study. Eighteen subjects (24.7 percent) reported using the Internet less than one hour per week. Five participants (6.8 percent) indicated using the Internet between five and ten hours per week. Those with the greatest frequency of Internet use per week, more than ten hours, account for 6.8 percent of respondents in this study. Nine participants (12.3 percent) responded that they have never used the Internet.

Table 4-7. Frequency Measures for Frequency of Internet Use

Frequency of Use	Frequency	Percent	Cumulative Percent
Never Used	9	12.3	12.3
Less than 1 Hour	18	24.7	37.0
1 to 4 Hours	36	49.3	86.3
5 to 10 Hours	5	6.8	93.1
More than 10 Hours	5	6.8	100.0
TOTAL	73	100.0	

Variety of Internet Use

Variety of Internet use is an indication of breadth of use, measured by the number of Internet services used by a participant (Finlay and Finlay, 1996). The question included in this study regarding use of Internet services was: "I have used the following Internet services...". Participants were prompted to mark all of the Internet services that they have used (World Wide Web, Newsgroups, E-mail, Gopher, FTP, IRC/Chat, other). Frequency measures for cumulative variety of use, representing the total number of Internet services used, are reported in Table 4-8.

Thirty-two respondents (43.8 percent) reported using two Internet services, while eleven (15.1 percent) have used only one tool. Over 27 percent of respondents reported using three or more Internet services. Ten participants (13.7 percent) reported no use of Internet services. The mean number of Internet services was 2.05, with a standard deviation of 1.32 and a variance of 1.75.

Table 4-8. Frequency Measures for Variety of Internet Use

Number of Tools	Frequency	Percent	Cumulative Percent
0 Tools	10	13.7	13.7
1 Tool	11	15.1	28.8
2 Tools	32	43.8	72.6
3 Tools	10	13.7	86.3
4 Tools	5	6.8	93.1
5 Tools	5	6.8	100.0
TOTAL	73	100.0	

Combined Internet Use Score

A combined Internet use score was computed by summing the scores of four use variables: (1) access for Internet use, (2) history of Internet use, (3) frequency of Internet use, and (4) variety of Internet services used. A high Internet use score indicates an elevated combined level of Internet access, history, frequency, and variety of use. The possible range for this measure is 18 points, with a minimum score of 0 and maximum of 18. Frequency measures for this variable are found in Table 4-9.

Combined Internet use scores for this study ranged 18 points, from a minimum score of 0 to a maximum of 18. The mean score was 8.37, with a median score of 9. The scale's mode was 8, with a standard deviation of 3.97 and a variance of 15.80.

Reliability for the combined Internet use score was determined through a test of internal consistency. The Guttman split-half technique applied to this scale resulted in a high correlation coefficient of .88. Reliability analyses for the combined Internet use score can be found in Table G-5, Appendix G.

Demographic Variables

Demographic factors such as age, gender, income, and level of education are often related to attitude and personality differences. In order to investigate possible relationships between these variables in this study, a section of demographic information comprised of six questions was included. The questions relate to (1) gender, (2) grade level, (3) subject area, (4) formal education com-

Table 4-9. Frequency Measures for the Combined Internet Use Score

Combined Score	Frequency	Percent	Cumulative Percent
0	1	1.4	1.4
1	6	8.2	9.6
2	2	2.7	12.3
3	0	0.0	12.3
4	4	5.5	17.8
5	2	2.7	20.5
6	3	4.1	24.7
7	6	8.2	32.9
8	12	16.4	49.3
9	8	11.0	60.3
10	10	13.7	74.0
11	8	11.0	84.9
12	2	2.7	87.7
13	2	2.7	90.4
14	2	2.7	93.2
15	2	2.7	95.9
16	1	1.4	97.3
17	1	1.4	98.6
18	1	1.4	100.0
TOTAL	73	100.0	

pleted, (5) age, and (6) total household income. Measures of central tendency and dispersion for all demographic variables are found in Table I-3, Appendix I.

Gender

Gender was determined by participants indicating their gender on the questionnaire. Frequency measures related to the gender of respondents are presented in Table 4-10. Results show that female teachers make up the largest group in this study (69.9 percent), while male teachers account for 30.1 percent of participants.

Table 4-10. Frequency Measures for Gender

Gender	Frequency	Percent	Cumulative Percent
Male	22	30.1	30.1
Female	51	69.9	100.0
TOTAL	73	100.0	

Grade Level

Grade level was determined by participants indicating the grade level(s) that they teach. The complete frequency distribution of the grade level variable can be found in Table I-4, Appendix I.

For the purpose of this study, grade level responses were collapsed into three categories: (1) Elementary School, (2) Middle School, and (3) High School. Frequency measures for the combined grade level categories are presented in

Table 4-11. Elementary school teachers comprise 42.5 percent of the respondents, middle school teachers make up 27.4 percent, and high school teachers account for 30.1 percent.

Table 4-11. Frequency Measures for the Combined Grade Level Variable

Grade Level	Frequency	Percent	Cumulative Percent
Elementary School (K-5)	31	42.5	42.5
Middle School (6-8)	20	27.4	69.9
High School (9-12)	22	30.1	100.0
TOTAL	73	100.0	

Subject Area

Subject area was determined by asking participants to indicate the subject area that they teach. The complete frequency distribution of the subject area variable can be found in Table I-5, Appendix I.

For the purpose of this study, subject area responses were collapsed into six general categories: (1) General/Elementary, (2) Math/Science, (3) English/Language Arts, (4) Social Studies/History/Health, (5) Music/Art, and (6) Counseling/Special Education/Speech Pathology. Frequency measures for these combined subject area categories are presented in Table 4-12.

Measures of this demographic variable show that twenty-eight participants (38.4 percent) teach all subject areas in their grade level (General/Elementary). Math and Science teachers account for 19.2 percent of the respondents. In addition, both English/Language Arts and Social Studies/Health teachers make

up 11.0 percent of those who responded to the questionnaire. Music and Art teachers account for 6.8 percent of respondents, while ten participants (13.7 percent) are Counselors, Special Education teachers, and Speech Pathologists.

Table 4-12. Frequency Measures for the Combined Subject Area Variable

Subject Area	Frequency	Percent	Cumulative Percent
General/Elementary	28	38.4	38.4
Math/Science	14	19.2	57.5
English/Lang. Arts	8	11.0	68.5
Social Studies/Health	8	11.0	79.5
Music/Art	5	6.8	86.3
Counseling/Special Ed	10	13.7	100.0
TOTAL	73	100.0	

Years of Teaching Experience

Teaching experience was measured by asking participants to indicate the number of years that they have been teaching. The complete frequency distribution of the years of teaching experience can be found in Table I-6, Appendix I.

For the purpose of this study, responses for years of teaching experience were collapsed into six categories: (1) 1-5 years, (2) 6-10 years, (3) 11-15 years, (4) 16-20 years, (5) 21-25 years, and (6) 25-30 years. Frequency measures for these categories are presented in Table 4-13.

The largest group of respondents (26 percent) represent those who have been teaching less than five years. Forty-one teachers (56.2 percent) have

between one and fifteen years of experience, whereas thirty-two teachers (43.8 percent) have between fifteen and thirty years of teaching experience.

Table 4-13. Frequency Measures for Combined Years of Teaching Experience

Years of Experience	Frequency	Percent	Cumulative Percent
1-5 Years	19	26.0	26.0
6-10 Years	13	17.8	43.8
11-15 Years	9	12.3	56.2
16-20 Years	12	16.4	72.6
21-25 Years	11	15.1	87.7
25-30 Years	9	12.3	100.0
TOTAL	73	100.0	

Education Level

Education level was measured in this study by the question: "What is the highest level of formal education that you have completed?" (some college, bachelor's degree, some graduate work, master's degree, educational specialist degree, doctoral or professional degree). Frequency measures for education level are reported in Table 4-14.

Thirty respondents (41.1 percent) reported completing a master's degree. Eleven respondents report having a bachelor's degree, whereas sixteen (21.9 percent) reported some graduate work beyond a bachelor's degree. Fifteen participants (20.5 percent) completed degrees beyond the master's level; twelve subjects (16.4 percent) have received educational specialist degrees, and three participants (4.1 percent) have earned doctoral or professional degrees. One

participants (1.4 percent) reported some college coursework, without completing a formal degree.

Table 4-14. Frequency Measures for Education Level

Education Level	Frequency	Percent	Cumulative Percent
Some college	1	1.4	1.4
Bachelor's degree	11	15.1	16.4
Some graduate work	16	21.9	38.4
Master's degree	30	41.1	79.5
Ed.S. degree	12	16.4	95.9
Doctoral degree	3	4.1	100.0
TOTAL	73	100.0	

Age

Age was measured in this study by the question: "What is your age?" (20-29 years, 30-39 years, 40-49 years, 50-59 years, 60-69 years, 70+ years). Frequency measures for age are reported in Table 4-15.

Respondents between the age of forty and forty-nine make up the largest group (42.5 percent) in this study. Fourteen participants (19.2 percent) were between the ages of twenty and twenty-nine; and twenty participants (27.4 percent) were in their thirties. These two groups (20-29 and 30-39) make up nearly half (46.6 percent) of the participants in this study. Seven of those who responded to the questionnaire (9.6 percent) were in their fifties, and only one respondent (1.4 percent) was sixty to sixty-nine years old.

Table 4-15. Frequency Measures for Age

Age	Frequency	Percent	Cumulative Percent
20-29	14	19.2	19.2
30-39	20	27.4	46.6
40-49	31	42.5	89.0
50-59	7	9.6	98.6
60-69	1	1.4	100.0
TOTAL	73	100.0	

Household Income

Household income was measured by the question: "What is your total household income before taxes for the current calendar year?" (less than $25,000; $25,000-$50,000; $50,000-$75,000; $75,000-$100,000; more than $100,000). Frequency measures for total household income are reported in Table 4-16.

Respondents with a household income between $25,000 and $50,000 make up the largest group (35.7 percent) in this study. The second largest group are the twenty-one participants who claimed an annual household income between $75,000 and $100,000 (30.0 percent). Five respondents (7.1 percent) reported an income of less than $25,000, seventeen (24.3 percent) indicated an annual income of between $50,000 and $75,000, and two participants (2.9 percent) claimed a household income over $100,000. Three subjects (4.1 percent) did not respond to this question.

Table 4-16. Frequency Measures for Household Income

Income	Frequency	Percent	Cumulative Percent
Less than $25,000	5	6.8	6.8
$25,000-$50,000	25	34.2	41.0
$50,000-$75,000	17	23.3	64.3
$75,000-$100,000	21	28.8	93.1
Over $100,000	2	2.7	95.8
No Response	3	4.1	100.0
TOTAL	73	100.0	

Hypothesis Testing

A hypothesis is "a statement about the relationship between two or more variables which can be empirically tested" (Reid, 1987, p. 44). The following relationships were tested for this study: (1) Innovativeness and Internet attitude, (2) innovativeness and Internet use, (3) Internet attitude and Internet use, and (4) demographic variables and innovativeness.

Hypothesis 1: Innovativeness and Internet Attitude

Research indicates that innovativeness is related to overall positive attitudes towards new experiences and novel stimuli (Leavitt & Walton, 1975), instructional media (Huang, 1994), new technology (Craig et al., 1995), and the Internet (Finlay & Finlay, 1996); therefore, the following was hypothesized:

H1 Teachers who are innovative adopters are hypothesized to have higher positive attitudes toward the use of the Internet than other adopter types.

The statistical hypothesis that was tested is:

H_0: $\mu_1 = \mu_2 = \mu_3$

H_a: At least two adopter type means (μ_is) differ with respect to Internet attitude

Where:

μ_1 is the population mean of the laggard adopter type

μ_2 is the population mean of the majority adopter type

μ_3 is the population mean of the innovator adopter type

In the means comparison of Internet attitude and adopter type, presented in Table 4-17, all adopter types appear to differ with respect to attitude toward using the Internet.

An analysis of variance was conducted to test the hypothesis, and the difference in means was found to be significant, $F(2,70) = 24.50$, $p < .001$. Therefore, the null hypothesis was rejected and it was concluded that there exists a significant difference between the means of at least two adopter types. Results of the ANOVA are presented in Table 4-18.

In order to test for differences in individual adopter type means, the Tukey HSD procedure was performed on the data. This post-hoc test revealed that all pairwise differences among means were significant, $p < .01$. The mean

Table 4-17. Internet Attitude and Adopter Type Means Comparison

			N	Mean	Std. Deviation	Std. Error
Internet Attitude	Adopter Type	Laggard	12	49.92	15.90	4.60
		Majority	49	68.00	11.00	1.57
		Innovator	12	81.67	3.82	1.10
		TOTAL	73	67.27	14.38	1.68

attitudes of innovators are higher than both laggard and majority, and the means of all groups differ significantly from each other. Results of the Tukey post-hoc procedure can be found in Table J-1, Appendix J.

Table 4-18. Internet Attitude and Adopter Type Analysis of Variance

		Sum of Squares	df	Mean Square	F	Sig.
Internet Attitude	Between Groups	6126.94	2	3063.47	24.50	< .001
	Within Groups	8753.58	70	125.05		
	TOTAL	14880.52	72			

Hypothesis 2: Innovativeness and Internet Use

Innovators are often characterized as "venturesome", a term which refers to the "willingness to take risks with respect to the adoption of new idea" (Robertson, 1971). In consumer studies research, early adopters have been found to show more favorable attitude toward science and technology than later adopters (Rogers, 1995; Robertson, 1971). In educational technology, early adopters are characterized as those searching for breakthroughs in instructional methods that new applications for technology enable (Geoghegan, 1994). Based upon these studies, the following hypotheses were proposed: Teachers who are innovative adopters are hypothesized to have (1) a longer history, (2) a greater frequency, and (3) a greater variety of Internet use than other adopter types.

Hypothesis 2a

H2a Teachers who are innovative adopters are hypothesized to have a longer history of Internet use than other adopter types.

The statistical hypothesis that was tested is:

H_0: $\mu_1 = \mu_2 = \mu_3$

H_a: At least two adopter type means (μ_is) differ with respect to history of Internet use

Where:

μ_1 is the population mean of the laggard adopter type

μ_2 is the population mean of the majority adopter type

μ_3 is the population mean of the innovator adopter type

The means comparison of history of Internet use and adopter type is presented in Table 4-19. From this comparison, it appears that all adopter types differ with respect to history of Internet use.

An analysis of variance was conducted to test the hypothesis, and the difference in means was found to be significant, $F(2,70) = 7.39$, $p < .01$. Therefore, the null hypothesis was rejected and it was concluded that there exists a difference between the means of at least two adopter types, with respect to history of Internet use. Results of the ANOVA are presented in Table 4-20.

In order to test for differences in individual adopter type means, the Tukey HSD procedure was performed on the data. This post-hoc test revealed that pairwise differences among means exist between (1) laggard and majority, $p < .05$; and (2) laggard and innovator, $p < .01$. Complete results of the Tukey HSD procedure are found in Table J-2, Appendix J.

Table 4-19. History of Internet Use and Adopter Type Means Comparison

			N	Mean	Std. Deviation	Std. Error
History of Internet Use	Adopter Type	Laggard	12	1.25	1.29	.37
		Majority	49	2.37	1.25	.18
		Innovator	12	3.08	.67	.19
		TOTAL	73	2.30	1.29	.15

Table 4-20. History of Internet Use and Adopter Type Analysis of Variance

		Sum of Squares	df	Mean Square	F	Sig.
History of Internet Use	Between Groups	20.82	2	10.40	7.40	.001
	Within Groups	98.55	70	1.41		
	TOTAL	119.37	72			

Hypothesis 2b

H2b Teachers who are innovative adopters are hypothesized to have a greater frequency of Internet use than other adopter types.

The statistical hypothesis that was tested is:

H_0: $\mu_1 = \mu_2 = \mu_3$

H_a: At least two adopter type means (μ_is) differ with respect to frequency of Internet use

Where:

μ_1 is the population mean of the laggard adopter type

μ_2 is the population mean of the majority adopter type

μ_3 is the population mean of the innovator adopter type

In the means comparison of frequency of Internet use and adopter type, presented in Table 4-21, all adopter types appear to differ with respect to frequency of Internet use.

An analysis of variance was conducted to test the hypothesis, and the difference in means was significant, $F(2,70) = 8.54$, $p < .01$. Therefore, the null hypothesis was rejected and it was concluded that there exists a difference between the means of at least two adopter types, with respect to frequency of Internet use. Results of the ANOVA are presented in Table 4-22.

The Tukey HSD procedure was performed on the data to test for differences in individual adopter type means. The post-hoc test revealed that pairwise differences among means exist between (1) laggard and majority,

Table 4-21. Frequency of Internet Use and Adopter Type Means Comparison

			N	Mean	Std. Deviation	Std. Error
Frequency of Internet Use	Adopter Type	Laggard	12	.83	.83	.24
		Majority	49	1.80	.94	.13
		Innovator	12	2.33	.89	.26
		TOTAL	73	1.73	1.00	.12

Table 4-22. Frequency of Internet Use and Adopter Type Analysis of Variance

		Sum of Squares	df	Mean Square	F	Sig.
Frequency of Internet Use	Between Groups	14.23	2	7.11	8.54	< .001
	Within Groups	98.56	70	.83		
	TOTAL	72.52	72			

$p < .01$; and (2) laggard and innovator, $p < .01$. Complete results of the Tukey HSD procedure can be found in Table J-2, Appendix J.

Hypothesis 2c

H2c Teachers who are innovative adopters are hypothesized to have a greater variety of Internet use than other adopter types.

The statistical hypothesis that was tested is as follows:

H_0: $\mu_1 = \mu_2 = \mu_3$

H_a: At least two adopter type means (μ_is) differ with respect to variety of Internet use

Where:

μ_1 is the population mean of the laggard adopter type

μ_2 is the population mean of the majority adopter type

μ_3 is the population mean of the innovator adopter type

Table 4-23 presents the means comparison for variety of Internet use and adopter type. All means of adopter types appear to differ with respect to variety of Internet use. An analysis of variance was conductedto test the hypothesis. The difference in means was found to be significant, $F(2,70) = 3.70$, $p < .05$, therefore, the null hypothesis was rejected. It was concluded that there exists a difference between the means of at least two adopter types, with respect to variety of Internet use. Results of the analysis of variance are presented in Table 4-24.

The Tukey HSD procedure was performed on the data to test for differences in individual adopter type means. This post-hoc test revealed that pairwise differences among means exist only between laggard and innovator adopter

Table 4-23. Variety of Internet Use and Adopter Type Means Comparison

			N	Mean	Std. Deviation	Std. Error
Variety of Internet Use	Adopter Type	Laggard	12	1.33	1.56	.45
		Majority	49	2.06	1.21	.17
		Innovator	12	2.75	1.22	.35
		TOTAL	73	2.05	1.32	.15

Table 4-24. Variety of Internet Use and Adopter Type Analysis of Variance

		Sum of Squares	df	Mean Square	F	Sig.
Variety of Internet Use	Between Groups	12.05	2	6.02	3.71	.029
	Within Groups	113.73	70	1.63		
	TOTAL	125.78	72			

types, $p < .05$. Complete results of the Tukey HSD procedure are presented in Table J-2, Appendix J.

Hypothesis 3: Internet Attitude and Internet Use

Studies show that as individuals have more computer experience with respect to a variety of software, they have less computer anxiety (McInerney et al., 1990; Reed et al., 1995). In addition, experience with computer equipment and the use of computers has been found to reduced anxiety and increase attitude (Kolehmainen, 1992). Based upon these finding, the following hypotheses are tested in this study: Teachers who have positive attitudes toward the use of the Internet are hypothesized to have (1) a longer history of Internet use, (2) a higher frequency of Internet use, and (3) a greater variety of Internet tool use.

Hypothesis 3a

H3a Teachers who have high positive attitudes toward the use of the Internet are hypothesized to have a longer history of Internet use.

The statistical hypothesis that was tested is:

H_0: $\beta = 0$

H_a: $\beta > 0$

The Pearson Product moment correlation method was used to test this hypothesis. The independent variable (x) was the score for Internet attitude, and the dependent variable (y) was the score for history of Internet use. Results of the correlation are presented in Table 4-25.

The test resulted in a correlation coefficient of .52 between attitude toward the use of the Internet and history of Internet use. This coefficient is significant at the .01 level, and indicates a moderate relationship between the two variables. Therefore, the null hypothesis was rejected, and it was concluded that there exists a significant positive relationship between attitude toward the use of the Internet and history of Internet use. Based upon an R square value of .27, it is believed that attitude toward the use of the Internet contributes 27% to the population's history of Internet use.

Table 4-25. Internet Attitude and Internet Use Correlations

		History of Internet Use	Frequency of Internet Use	Variety of Internet Use
Pearson Correlation	Internet Attitude	.52**	.54**	.53**

** Correlation is significant at the .01 level (2-tailed)

Hypothesis 3b

H3b Teachers who have high positive attitudes toward the use of the Internet are hypothesized to have a greater frequency of Internet use.

The corresponding statistical hypothesis that was tested is:

H_0: $\beta = 0$

H_a: $\beta > 0$

In order to test this hypothesis, the Pearson Product moment correlation method was used. The independent variable (x) was the score for Internet attitude, the dependent variable (y) was the score for frequency of Internet use. Results of the correlation are presented in Table 4-25.

The test resulted in a correlation coefficient of .54 between attitude toward the use of the Internet and frequency of Internet use. This coefficient is significant at the .01 level, and indicates a moderate relationship between the two variables. The null hypothesis was rejected, and it was concluded that there exists a significant positive relationship between attitude toward the use of the Internet and frequency of Internet use. The R square value of .29 reveals that attitude toward the use of the Internet contributes 29% to the population's frequency of Internet use.

Hypothesis 3c

H3c Teachers who have high positive attitudes toward the use of the Internet are hypothesized to have a greater variety of Internet use.

The statistical hypothesis that was tested is as follows:

H_0: $\beta = 0$

H_a: $\beta > 0$

To test this hypothesis, the Pearson Product moment correlation method was employed. The independent variable (x) was the score for attitude toward the use of the Internet, and the dependent variable (y) was the score for variety of Internet services used. Results of the test are shown in Table 4-25.

The correlation resulted in a coefficient of .53 between innovativeness and variety of Internet use. This coefficient is significant at the .01 level, and indicates a moderate relationship between the two variables. Therefore, the null hypothesis was rejected, and it was concluded that there does exist a significant positive relationship between attitude toward the use of the Internet and variety of Internet use. The R square value of .28 indicates that attitude toward the use of the Internet contributes 28% to the population's variety of Internet services used.

Hypothesis 4: Innovativeness and Demographic Variables

Age, income, and education are the most common demographic variables cited as factors related to innovativeness. In consumer studies (Robertson, 1971) where an innovator's income was taken into account, the majority of studies show higher income levels to be associated with higher levels of innovativeness. Additionally, Webster (1967) reports that a higher level of education leads to an individual's better use of information, and to an increase in one's tolerance for risk taking. Based upon these findings, the following hypotheses were tested in this study: Teachers who are innovative are hypothesized to (1) have a higher

level of education, (2) belong to a younger age group, and (2) have a higher level of income than other members of the population.

Hypothesis 4a

H4a Teachers who possess a high level of formal education are hypothesized to be more innovative than other members of the population.

The statistical hypothesis that was tested is:

H_0: $\mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu_5$

H_a: At least two educational level means (μ_is) differ with respect to innovativeness

Where:

μ_1 is the population mean of the bachelor's degree group

μ_2 is the population mean of the some graduate work group

μ_3 is the population mean of the master's degree group

μ_4 is the population mean of the Ed.S. degree group

μ_5 is the population mean of the doctoral degree group

In the comparison of means, presented in Table 4-26, level of education does not appear to differ significantly with respect to innovativeness. An ANOVA was conducted to test the hypothesis, the results are presented in Table 4-27. The difference in means was found to not be significant, $F(4,68) = 1.19$, $p = .32$. Therefore, the null hypothesis was accepted and no further tests were performed. With respect to level of education and innovativeness, it was concluded that there exists no significant difference in group means.

Table 4-26. Innovativeness and Education Means Comparison

			N	Mean	Std. Deviation	Std. Error
Innovativeness Scale	Education	bachelor's	12	98.42	34.32	9.91
		graduate work	16	114,56	15.42	3.86
		master's	30	107.43	23.01	4.20
		Ed.S.	12	111.83	17.04	4.92
		doctoral	3	121.33	8.39	4.84
		TOTAL	73	108.81	22.88	2.68

Table 4-27. Innovativeness and Education Analysis of Variance

		Sum of Squares	df	Mean Square	F	Sig.
Innovativeness Scale	Between Groups	2462.76	4	615.69	1.19	.324
	Within Groups	35214.55	68	517.86		
	TOTAL	37677.32	72			

Hypothesis 4b

H4b Teachers who belong to a younger age group are hypothesized to be more innovative than other members of the population.

The tested statistical hypothesis is as follows:

H_0: $\mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu_5$

H_a: At least two age group means (μ_is) differ with respect to innovativeness

Where:

μ_1 is the population mean of the 20-29 age group

μ_2 is the population mean of the 30-39 age group

μ_3 is the population mean of the 40-49 age group

μ_4 is the population mean of the 50 and over age group

In the comparison of means, presented in Table 4-28, age means appear to differ slightly with respect to innovativeness. An analysis of variance was conducted to test the hypothesis. The difference in means was found to be significant, $F(3,69) = 4.03$, $p = .01$. Therefore, the null hypothesis was rejected and it was concluded that a difference does exist between the means of at least two age groups, with respect to level of innovativeness. Results of the ANOVA are presented in Table 4-29.

The Tukey HSD procedure was performed on the data in order to test for differences between individual age group means. This post-hoc test revealed that pairwise differences among means exist between the "30-39" and "over 50" age groups, $p < .05$. Complete results of the Tukey HSD procedure can be found in Table J-3, Appendix J.

Table 4-28. Innovativeness and Age Means Comparison

			N	Mean	Std. Deviation	Std. Error
Innovativeness Scale	Age	20-29	14	118.29	14.44	3.86
		30-39	20	117.25	17.40	3.89
		40-49	31	103.06	23.39	4.20
		50 and over	8	93.38	32.06	11.33
		TOTAL	73	108.81	22.88	2.68

Table 4-29. Innovativeness and Age Analysis of Variance

		Sum of Squares	df	Mean Square	F	Sig.
Innovativeness Scale	Between Groups	5610.96	3	1870.32	4.03	.011
	Within Groups	32066.35	69	464.73		
	TOTAL	37677.32	72			

Hypothesis 4c

H4c Teachers who belong to a higher income group are hypothesized to be more innovative than other members of the population.

The statistical hypothesis that was tested is:

H_0: $\mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu_5$

H_a: At least two income group means (μ_is) differ with respect to innovativeness

Where:

μ_1 is the population mean of the less than $25,000 income group

μ_2 is the population mean of the $25,000-$50,000 income group

μ_3 is the population mean of the $50,000-$75,000 income group

μ_4 is the population mean of the over $75,000 income group

Level of income means do not appear to differ significantly, with respect to innovativeness, in the comparison of means presented in Table 4-30. An analysis of variance was conducted to test the hypothesis, and the difference in means was not found to be significant, $F(3,66) = .47$, $p = .71$. The null hypothesis, therefore, was accepted. It was concluded that there exists no significant difference between means, regarding annual household income and innovativeness. Results of the ANOVA are presented in Table 4-31.

Additional Findings

In addition to the hypotheses tested for this study, further significant findings were discovered in the relationship between (1) innovativeness, (2) attitude toward using the Internet, and (3) demographic variables in the teacher population. The findings from these tests are presented in this section.

Table 4-30. Innovativeness and Income Means Comparison

			N	Mean	Std. Deviation	Std. Error
Innovativeness Scale	Income	< $25,000	5	101.80	36.51	16.33
		$25-50,000	25	113.72	16.77	3.35
		$50-75,000	17	109.24	24.50	5.94
		> $75,000	23	109.00	23.07	4.81
		TOTAL	70	110.23	22.23	2.66

Table 4-31. Innovativeness and Income Analysis of Variance

		Sum of Squares	df	Mean Square	F	Sig.
Innovativeness Scale	Between Groups	711.44	3	237.15	.47	.705
	Within Groups	33388.90	66	505.89		
	TOTAL	34100.34	69			

Additional Innovativeness Findings

In addition to the demographic variables that were testing in the preceding hypotheses, gender was also measured with respect to level of innovativeness. The means comparison for these two variables is presented in Table 4-32. From this comparison, it appears that innovativeness means scores are significantly higher for female teachers than for male teachers.

In order to test these means for a significance difference, an analysis of variance was conducted. As a result of the ANOVA, the difference in means was found to be significant, $F(1,71) = 7.83$, $p < .01$. Therefore, it was concluded that there does exist a difference between the means of male and female teachers, with respect to level of innovativeness. Female teachers in this population had

significantly higher innovativeness scores than male teachers. Results of the ANOVA are presented in Table K-1, Appendix K.

Subject area and grade level are two demographic variables, related to teaching, that were tested as independent variables with respect to innovativeness. The means comparisons for these variables are presented in Table 4-33. In terms of teachers' subject area, it appears that innovativeness mean scores are significantly higher for general subject area and music/art groups, than for math/science teacher groups.

To test for significance difference in mean scores, ANOVAs were conducted. As a result of the ANOVA between innovativeness and subject area, the difference in means was found to be significant, $F(5,67) = 2.32$, $p = .05$. It was concluded that there does exist a difference between the means of at least two subject area groups, with respect to level of innovativeness. The Tukey post-hoc test was conducted on the data to differentiate the specific differences. The results of this test indicate that the general subject area teacher group had significantly higher innovativeness scores than the math/science teachers group. Results of the ANOVA and Tukey HSD test are presented in Table K-2, Appendix K; and Table K-3, Appendix K, respectively.

Table 4-32. Innovativeness and Gender Means Comparison

Dep. Variable	Ind. Variable		N	Mean	Std. Deviation	Std. Error
Innovativeness Scale	Gender	Male	22	97.91	26.36	5.62
		Female	51	113.51	19.67	2.75
		Total	73	108.81	22.88	2.68

The result of the ANOVA between innovativeness and grade level did not find the difference in means to be significant, $F(2, 70) = 1.36$, $p=.26$. Therefore, it was concluded that there does not exist a difference between the means of at least two grade level groups, with respect to level of innovativeness. Results of the ANOVA are presented in Table K-4, Appendix K.

The relationship between the demographic variables (1) gender, (2) subject area, and (3) grade level was further explored in this study. From the reports of means scores, it was observed that male teachers in the middle and high schools who taught math and math/science courses appeared to posses significantly lower innovativeness scores than other groups of male and female teachers. In order to test this assumption, an analysis of variance was conducted between innovativeness scores and teacher type. For this measure, teacher type was defined as one of (1) male teachers who do not teach math, (2) male math teachers, or (3) all female teachers.

Table 4-33. Innovativeness and Teacher Variables Means Comparison

Dep. Variable	Ind. Variable		N	Mean	Std. Deviation	Std. Error
Innovativeness Scale	Subject Area	Gen/Elem	28	116.14	16.72	3.16
		Math/Science	14	94.14	28.72	7.68
		English/Lang	8	101.00	28.33	10.02
		Soc Studies	8	111.13	22.84	8.07
		Music/Art	5	118.80	18.16	8.12
		Special Ed	10	108.20	19.04	6.02
		Total	73	108.81	22.88	2.68
Innovativeness Scale	Grade Level	Elementary	31	112.23	18.11	3.25
		Middle School	20	110.80	16.99	3.80
		High School	22	102.18	31.58	6.73
		Total	73	108.81	22.88	2.68

Results of this ANOVA, presented in Table K-5, Appendix K, show that mean differences exist between at least two groups, $F(2,70) = 11.32$, $p < .01$. A Tukey post-hoc test (Table K-6, Appendix K) further revealed that the mean innovativeness scores of male math teachers were significantly lower than both (1) male teachers who do not teach math, (2) all female teachers. However, it was found that there does not exist a significant difference in innovativeness scores between male teachers who do not teach math and all female teachers in this population.

Additional Internet Attitude Findings

Demographic factors such as gender, level of education, and age are often related to attitude and personality differences. In order to investigate possible relationships between these variables in this study, ANOVAs were performed with the Internet Attitude Scale score and these three independent variables. The means comparisons for all three variables are presented in Table 4-34.

From the comparison of means between Internet attitude and gender, it appears that scores are substantially higher for female teachers than for male teachers. An analysis of variance was conducted in order to test these means for a significance difference. As a result of the ANOVA, the difference in means was found to be significant, $F(1,71) = 3.89$, $p = .05$. Based upon the test results, it was concluded that there does exist a difference between the means of male and female teachers, with respect to attitude toward using the Internet. Female teachers in this population had significantly higher Internet attitude scores. Results of the ANOVA for these two variables are presented in Table K-7, Appendix K.

In light of the findings reported previously, regarding low innovativeness scores of male middle and high school math and math/science teachers, an ANOVA was employed to test for means differences between Internet attitude and teacher type. For this measure, teacher type was defined as one of (1) male teachers who do not teach math, (2) male math teachers, or (3) all female teachers. Results of the ANOVA, presented in K-8, Appendix K, reveal that there was a significant difference between the mean Internet attitude scores of at least two of these groups, $F(2,70) = 6.19$, $p = < .01$. The post-hoc test (K-9, Appendix K) shows that the mean scores of male math teachers are significantly lower than both (1) male teachers who do not teach math, (2) all female teachers. It was further revealed that there does not exist a significant difference in Internet

Table 4-34. Internet Attitude and Demographic Variables Means Comparison

Dep. Variable	Ind. Variable		N	Mean	Std. Deviation	Std. Error
Internet Attitude	Gender	Male	22	62.32	14.38	3.07
		Female	51	69.41	13.97	1.96
		Total	73	67.27	14.38	1.68
Internet Attitude	Education	Bachelor's Degree	12	63.08	20.78	6.00
		Some Graduate	16	67.50	14.94	3.74
		Master's Degree	30	67.17	12.74	2.33
		Ed.S. Degree	12	70.08	11.60	3.35
		Doctorate	3	72.67	10.02	5.78
		Total	73	67.27	14.38	1.68
Internet Attitude	Age	20-29	14	68.57	13.63	3.64
		30-39	20	70.75	11.98	2.68
		40-49	31	67.45	13.29	2.39
		50 +	8	55.62	21.00	7.43
		Total	73	67.27	14.38	1.68

attitude scores between male teachers who do not teach math and all female teachers in this population.

The result of the analysis of variance conducted with Internet attitude and level of formal education, found the difference in means to not be significant, $F(4,68) = .46$, $p = .76$. It was concluded that there exists no statistical significance, in this population, between level of formal education and attitude toward using the Internet. Results of the ANOVA are found in Table K-10, Appendix K.

Age was the third independent variable tested with Internet attitude in an analysis of variance. In this ANOVA, the difference in means was not found to be significant, $F(3,69) = 2.30$, $p = .09$. It was concluded, therefore, that in this population there exists no significance relationship between age and attitude toward using the Internet. Results of the ANOVA are found in Table K-11, Appendix K.

Table 4-35. Internet Attitude and Teacher Variables Means Comparison

Dep. Variable	Ind. Variable		N	Mean	Std. Deviation	Std. Error
Internet	Subject	Gen/Elem	28	69.07	14.54	2.75
Attitude	Area	Math/Science	14	60.07	16.74	4.48
		English/Lang	8	63.00	16.62	5.88
		Soc Studies	8	69.25	13.01	4.60
		Music/Art	5	71.00	10.86	4.86
		Special Ed	10	72.30	8.30	2.62
		Total	73	67.27	14.38	1.68
Internet	Grade	Elementary	31	66.45	13.75	2.47
Attitude	Level	Middle School	20	70.40	10.34	2.31
		High School	22	65.59	18.12	3.86
		Total	73	67.27	14.38	1.68

Subject area and grade level, two demographic variables related to teaching, were also tested as independent variables with respect to attitude toward using the Internet. Means comparisons for these variables are presented in Table 4-35. Scores, with respect to subject area, appear to bear no pattern of differences. However, means of grade level scores appear to be substantially higher for high school teachers than for elementary school teachers.

ANOVAs were conducted to test for significance difference in mean scores for both of the independent variables. As a result of the ANOVA between Internet attitude and subject area, the difference in means was not significant, $F(5,67) = 1.30$, $p = .27$. It was concluded that there does not exist a difference between the means of at least two subject area groups, with respect to level of attitude toward the use of the Internet. Results of this ANOVA are presented in Table K-12, Appendix K.

The analysis of variance between Internet attitude and grade level did not resulted in a significant difference in means, $F(2, 70) = .67$, $p=.52$. Therefore, it was concluded that there does not exist a difference between the means of at least two grade level groups. Results are presented in Table K-13, Appendix K.

Summary of Research Results

This study examined the relationship between teachers' innovativeness, attitude toward the use of the Internet, and Internet use. The results of descriptive statistics and hypothesis testing were presented in this chapter. One-way analysis of variance and Pearson Product moment correlations were used in testing the hypotheses. Results of those tests are summarized in Table 4-36.

Table 4-36. Summary of Research Hypotheses

	Independent Variable	Dependent Variable	Test	R	P
H1	Innovativeness	Internet Attitude	ANOVA		< .01**
H2a	Innovativeness	History of Internet Use	ANOVA		.01**
H2b	Innovativeness	Frequency of Internet Use	ANOVA		< .01**
H2c	Innovativeness	Variety of Internet Use	ANOVA		.03*
H3a	Internet Attitude	History of Internet Use	Correlation	.52**	
H3b	Internet Attitude	Frequency of Internet Use	Correlation	.54**	
H3c	Internet Attitude	Variety of Internet Use	Correlation	.53**	
H4a	Age	Innovativeness	ANOVA		.32
H4b	Education	Innovativeness	ANOVA		.01*
H4c	Income	Innovativeness	ANOVA		.70

** Significant at the .01 level
* Significant at the .05 level

The first hypothesis used an analysis of variance (ANOVA) to test for mean differences between adopter types and attitude toward using the Internet. As a result of this test, the difference was found to be significant, $F(2,70) = 24.50$, $p < .001$. The null hypothesis was rejected and it was concluded that there exists a difference between the means of at least two adopter types. A post-hoc test further revealed that all pairwise differences among means were significant, $p < .01$.

The second hypothesis employed an analysis of variance to test for differences in means between adopter types and the Internet use variables: (1) history , (2) frequency, and (3) variety of Internet use. Results indicate that history of Internet use ($F(2,70) = 7.39$, $p < .01$) and frequency of Internet use ($F(2,70) = 8.54$, $p < .01$) are significant at the .01 level, while variety of Internet use ($F(2,70) = 3.70$, $p < .05$) is significant at the .05 level. Post-hoc tests reveal

that for all three Internet use variables, the mean scores for innovators are significantly higher than the scores of laggards.

The third hypothesis examines the correlation between Internet attitude and Internet use. In order to test this relationship, Pearson correlations were run between Internet attitude and the Internet use variables: (1) history, (2) frequency, and (3) variety of Internet use. All tests resulted in correlation coefficients greater than .50. These coefficients are all significant at the .01 level, and indicate a moderate relationship between Internet attitude and each of the tested Internet use variables.

The fourth hypothesis used ANOVAs to test for differences in means between innovativeness and the demographic variables: (1) level of education, (2) age, and (3) annual household income. No significant differences were found with respect to level of education and innovativeness ($F(4,68) = 1.19$, $p = .32$), and annual household income and innovativeness ($F(3,66) = .47$, $p = .71$). Mean differences were, however, found to be significant ($F(3,69) = 4.03$, $p = .01$) between age and innovativeness. A Post-hoc test of these two variables reveals that the mean difference is significant between the "30-39" age group and the "over 50" group, $p < .05$. The younger age group had significantly higher innovativeness scores than the older group.

In addition to hypotheses testing, further areas of exploration involving demographic variables, innovativeness, and Internet attitude were examined in this chapter. A summary of these additional findings are presented in Table 4-37. With respect to innovativeness, the demographic variables: (1) gender, (2) subject area, and (3) grade level were all tested for significant differences in mean

Table 4-37. Summary of Additional Findings

Independent Variable	Dependent Variable	Test	P
Gender	Innovativeness	ANOVA	< .01**
Subject Area	Innovativeness	ANOVA	.05*
Grade Level	Innovativeness	ANOVA	.26
Gender	Internet Attitude	ANOVA	.05*
Age	Internet Attitude	ANOVA	.09
Education	Internet Attitude	ANOVA	.76
Subject Area	Internet Attitude	ANOVA	.27
Grade Level	Internet Attitude	ANOVA	.52

** Significant at the .01 level
* Significant at the .05 level

scores. Results of these ANOVAs indicate significant differences exist in this population with respect to gender ($F(1,71) = 7.83$, $p < .01$) and subject area ($F(5,67) = 2.32$, $p = .05$). Post-hoc tests of these variables reveals that (1) female teachers in this population had significantly higher innovativeness scores than male teachers, (2) male middle and high school math and math/science teachers had significantly lower innovativeness scores than other groups of male or female teachers, and (3) the general subject teacher group had significantly higher innovativeness scores than the math and science teacher group.

Attitude toward the use of the Internet was also tested with ANOVAs to find differences in mean scores with respect to the variables: (1) gender, (2) age, (3) level of education, (4) subject area, and (5) grade level. Results of the ANOVAs show significant differences only with respect to gender ($F(1,71) = 3.89$, $p = .05$). None of the other ANOVAs resulted in significant differences in mean scores. Results of these tests reveal that (1) female teachers in this

population had significantly higher attitudes toward the use of the Internet than male teachers, (2) male middle and high school math and math/science teachers had significantly lower Internet attitude scores than other groups of male or female teachers.

CHAPTER V

DISCUSSION

The purpose of this study was to measure the effects of innovativeness, Internet use, and demographic variables, on the attitude of teachers toward the use of the Internet. This chapter begins by drawing conclusions from tested hypotheses and additional findings as they relate to previous research in the areas of diffusion of innovations and Internet attitudes. This chapter also explores the implications of these findings, tying the need for the study together with research results. The chapter concludes with suggestions for further research in this area.

Conclusions

The results of the hypotheses testing for this study and other findings are examined and discussed, as they relate to previous research. Areas of consideration are (1) innovativeness and Internet attitude, (2) innovativeness and Internet use, (3) Internet attitude and Internet use, (4) innovativeness and demographic variables, (5) Internet attitude and demographic variables.

Innovativeness and Internet Attitude

Innovative adopter types are often found to possess higher overall positive attitudes towards new experiences and novel stimuli (Leavitt & Walton, 1975). Research on innovative adopter types and attitude toward instructional media (Huang, 1994), new technology (Craig et al., 1995), and the Internet

(Finlay & Finlay, 1996) strengthen these findings. The results from the test of the first hypothesis of this study corroborate these studies, as mean differences between adopter types and attitude toward using the Internet were found to be significant. Further analysis revealed that all pairwise differences among adopter type means were significant with attitude toward using the Internet. It was determined that the mean Internet attitude scores of innovators (81.67) are significantly higher than those of both the majority members (68.00) and laggards (49.92) in this population, as seen in figure 5-1.

Innovativeness and Internet Use

Innovative adopter types are often described as those who possess the "willingness to take risks in respect to the adoption of new idea" (Robertson, 1971). Research in this area has found that innovators and early adopters show more favorable attitudes toward science and technology than majority members

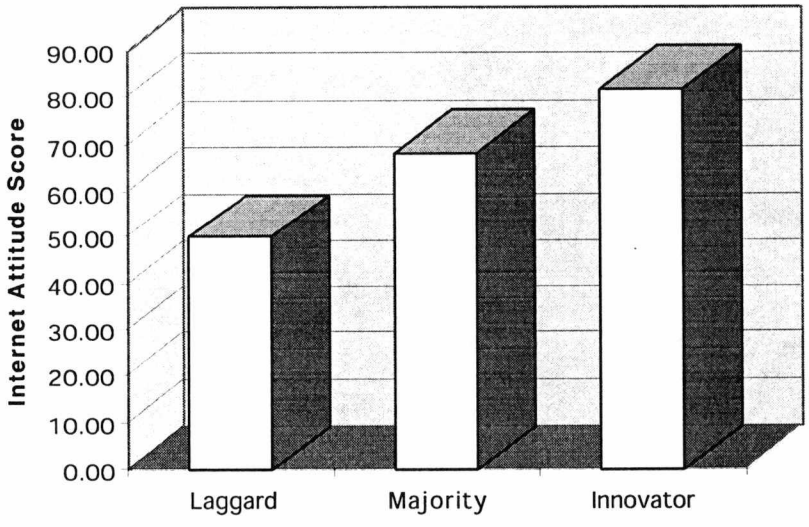

Figure 5-1. Mean Internet Attitude Scores of Adopter Types

and laggards (Rogers, 1995; Robertson, 1971). Moreover, in the field of educational technology, innovators are characterized as those who search for technological breakthroughs in instructional methods (Geoghegan, 1994). The findings of this study, in respect to innovativeness and Internet use, are in agreement with previous research findings.

Results from the tests of the second set of hypotheses show that mean scores of adopter types and the Internet use variables (1) history, (2) frequency, and (3) variety of Internet use are all significantly higher for innovators than for laggards. Similarly, mean differences between laggards and majority adopters were found to be significant in respect to history and frequency of Internet use. However, the mean differences between majority and innovator adopters were not found to be significant in any of the three Internet use variables.

The author believes that the lack of a difference in mean scores between innovators and majority members, as they relate to these three Internet use variables, is due to the fact that the Internet has already reached a level of adoption in this school system that includes both innovators and majority. This level of adoption is what Rogers (1995) refers to as "critical mass", a point in the adoption process at which "enough individuals have adopted an innovation so that the innovation's further rate of adoption becomes self-sustaining" (Rogers, 1995, p. 313). In relation to adopter categories, critical mass takes place at the point where the early majority begins the adoption process.

Proof to support this assumption can be found in findings from the descriptive statistics for this study, 87.7 percent of teachers in the Springfield City School System reported some previous Internet use. The researcher noted

that 61.6 percent of teachers reported having used the Internet for more than twelve months. However, nine participants in this study (12.5 percent) reported no prior use of the Internet. Since the mean scores of the three primary Internet use variables are all significant between (1) innovators and laggards and (2) majority and laggards, it was concluded that the 12.5 percent of Internet nonusers make up a large part of the 16 percent of this population deemed to be laggards. The relationship between adopter type and Internet use in this population is one where innovators and majority members are the ones who have used the Internet, whereas laggards have little experience using the Internet. Figure 5-2 depicts the mean levels of three Internet use variables for each adopter type.

Internet Attitude and Internet Use

Numerous studies have investigated the relationship between computer use, anxiety, attitude, experience, and training. Previous research has found that

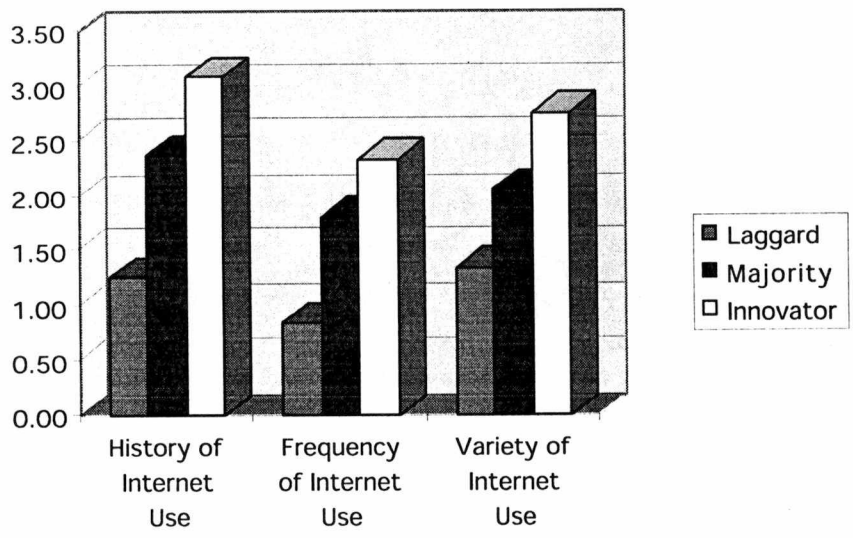

Figure 5-2. Mean Levels of Internet Use Variables for Adopter Types

as individuals have more computer experience in respect to a variety of software, they exhibit less computer anxiety (e.g., McInerney et al., 1990; Reed et al., 1995). Others show that experience with computer equipment and the use of computers has been linked to reduced anxiety and increase attitude toward use (Kolehmainen, 1992). However, there has been a void in the literature in respect to a direct correlation between positive computer attitudes and increased computer use. Some argue that there is little relationship between attitude and act (Shrigley, 1990). Others (Robertson, 1971) claim that changes in an individual's attitude toward a product directly relates to subsequent behavioral change toward its use.

This is the first study that has examined Internet specific variables with respect to computer attitudes and usage in the general K-12 teacher population. Findings from the third hypothesis of this study corroborate previous research on computer experience and attitude. The results also points to a positive correlational relationship between computer attitude and use.

The author contends, from the results of correlation tests in this study, that in this population there exists a moderate relationship between Internet attitude and each of the variables: (1) history, (2) frequency, and (3) variety of Internet use. All tests resulted in correlation coefficients greater than .50. These correlations produced R square values from .25 to .29, indicating a 25 to 29 percent relationship between attitude and the Internet use variables in this population. Therefore, it was determined that there exists a significant positive relationship between increased attitudes toward using the Internet and an increase in each (1) the history, (2) the frequency, and (3) the variety of teachers' Internet

use. Other possible variables that affect Internet use in this population, that were not measured in this study, are (1) time constraints, (2) motivation for use, and (3) need for use.

Innovativeness and Demographic Variables

Certain demographic variables are frequently cited as factors related to innovativeness; these include age, income, and education. Although the relationship between age and innovativeness is inconclusive, in some studies an increase in age is cited to have a negative correlation with innovativeness (Rogers, 1995). Studies have also shown that a higher level of formal education leads to an individual's better use of information, and to an increase in one's tolerance for risk taking and innovativeness (Webster, 1968). Additionally, in consumer studies where an innovator's income is taken into account, the majority show higher income levels to be associated with higher levels of innovativeness (Robertson, 1971).

The fourth hypothesis employed the use of ANOVAs to test for differences in means between innovativeness and each of these demographic variables: (1) level of education, (2) age, and (3) annual household income. No significant differences were found with respect to level of education or annual household income. The reason for the lack of significance is believed to be that these two variables are more uniform in this population than in those of many previous studies. With respect to education, all but one of the respondents to this study had obtained a bachelor's degree, three had doctoral degrees, and the majority (41 percent) had obtained master's degrees. Many of the studies (e.g., Robertson,

1971) that report higher levels of education related to increased innovativeness date from the 1960s, when there were fewer college graduates than there are today. Moreover, with respect to income, teachers' salaries are typically determined by their level of experience. Therefore, innovativeness in the workplace would not necessarily result in a higher income in this teacher population as it would in that of other occupations.

Mean differences were found to be significant with respect to age and innovativeness. The results reveal that younger teachers have higher mean scores for innovativeness than older groups. There was found to be a significant difference in innovativeness scores between the "30-39" age group and the "over 50" group. Mean scores are presented in Figure 5-3, showing the levels of innovativeness scores for the 20-29 age group (118.29), 30-39 group (117.25), 40-49 group (103.06), and over 50 age group (93.38).

Gender, subject area, and grade level are additional demographic variables which were tested with innovativeness level to uncover additional mean

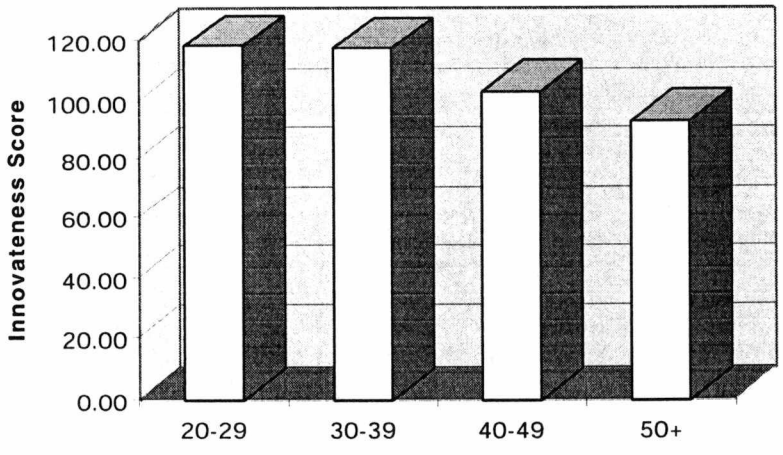

Figure 5-3. Mean Innovativeness Scores for Age Groups

differences. Results of these tests indicate significant differences exist in this population with respect to gender and subject area. In particular, it is held that (1) female teachers in this population had significantly higher innovativeness scores than male teachers, (2) male middle and high school math and math/ science teachers had significantly lower innovativeness scores than other groups of male or female teachers, and (3) the general subject teacher group had significantly higher innovativeness scores than the math and science teacher group.

The differences in scores between male and female teachers is related to the lower mean innovativeness scores for male math teachers, depicted in Figure 5-4. It shows that male middle and high school math teachers have significantly lower innovativeness scores (72.17) than males who do not teach math (107.56), and all female teachers (113.51). The score for these male math teachers (n=6) lessens the total mean score for all male teachers (97.91) to a level that is

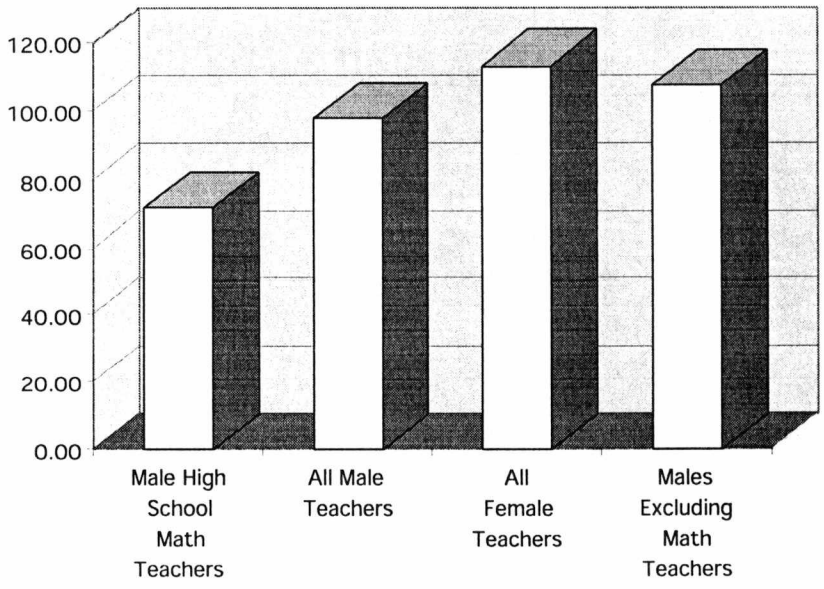

Figure 5-4. Mean Innovativeness Scores for Male Math Teachers

significantly different than the scores of all female teachers. When the mean scores of all males who do not teach math were tested against the mean scores of female teachers, however, there was found to be no significant difference. Therefore, gender differences observed in this population, with respect to innovativeness, are restricted to a specific group of male middle and high school math and math/science teachers.

In order to explain the discrepancy in scores between male math teachers and other members of the population, an examination of demographic variables was undertaken. Based upon previous findings in the literature of innovativeness, the author hypothesized that this group of male teachers may possess demographic traits linked to non-innovators; such as (1) having lower levels of education, (2) belonging to older age groups, and (3) possessing lower income levels than other members of the population. Figure 5-5 shows that the level of education for male high school math teachers (3.50) was lower than any of the other groups examined (all male teachers, 3.59; all female teachers, 3.73; and

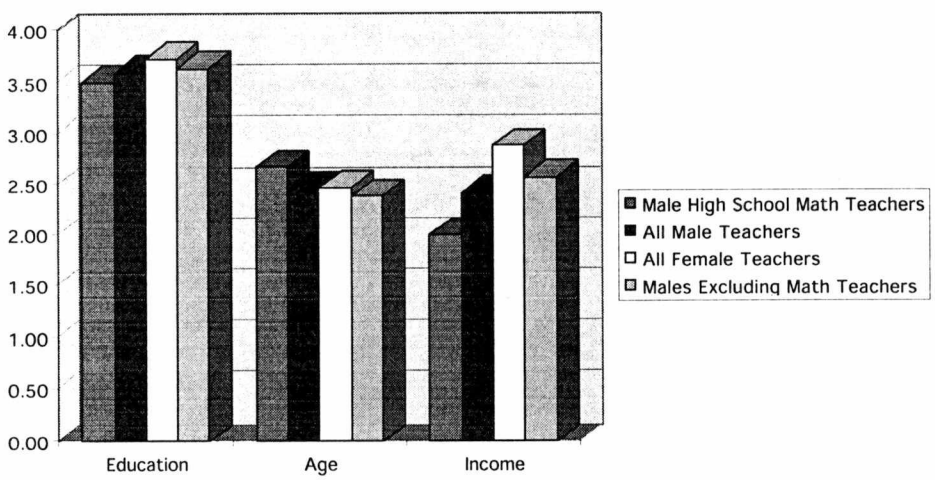

Figure 5-5. Demographic Variables of Male Math Teachers

male teachers excluding math, 3.63), In addition, the mean age for male math teachers (2.67) was higher than all other groups examined (all male teachers, 2.45; all female teachers, 2.47; and male teachers excluding math, 2.38). Income levels for male math teachers (2.00) were found to be lower than the mean scores for all other groups (all male teachers, 2.41; all female teachers, 2.88; and male teachers excluding math, 2.56). Therefore, the lower scores for innovativeness in the group of male math teachers may be a related to the existence of all three of these circumstances.

Those who teach all subjects in their grade level were reported to have significantly higher innovativeness scores than math and science teachers. This was a result of the group of math teacher who have previously been reported to have extremely low innovativeness scores. With this group taken out of the means testing, there were found to be no significant differences in mean scores with respect to subject and innovativeness.

Based upon the findings of this study on innovativeness level and demographic variables, it was concluded that the most innovative teachers in this population are those teachers who belong to a younger age group.

Internet Attitude and Demographic Variables

It was previously reported in this study that research on attitude and gender differences within individual teacher populations in the 1990s generally concur that there is no difference in attitudes between males and female teachers (Rosen and Maguire, 1990). Experience with computers, not gender, has been

found to be a more significant determinant of attitude in the literature (Krisiansen, 1991).

In order to search for possible relationships between Internet attitude and demographic variables in this population, a series of additional tests were performed. One-way ANOVAs were employed to test for significant differences in means scores for Internet attitude and each of the demographic variables: (1) gender, (2) age, (3) level of education, (4) subject area, and (5) grade level. Results indicate that there were significant differences with respect to gender in this population. This difference in attitude scores between male and female teachers was, however, related to the mean scores of male math teachers which are significantly lower than both (1) male teachers who do not teach math, (2) all female teachers. Figure 5-6 displays the impact of the lower score for math teachers (49.00) on the means scores for all male teachers (62.32). The difference

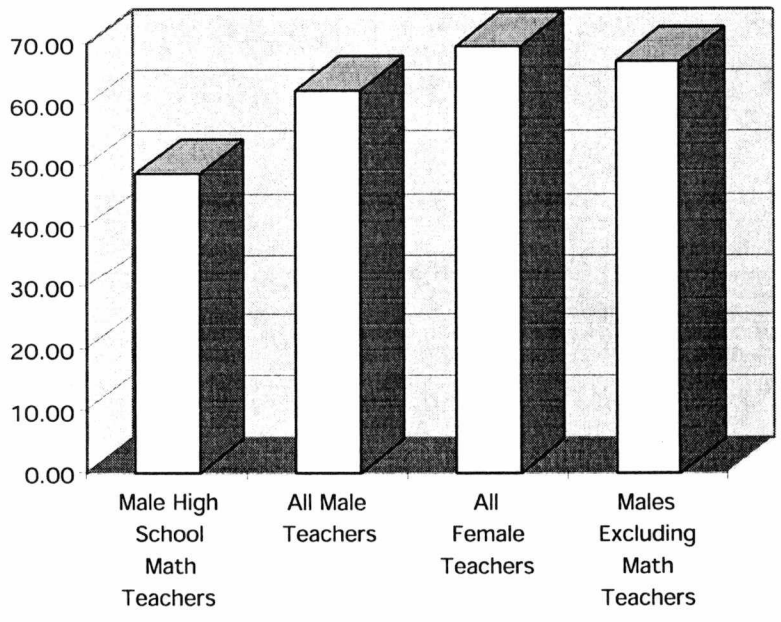

Figure 5-6. Internet Attitude Scores for Male Math Teachers

between all female teachers (69.41) and males, excluding math teachers (67.31), was not found to be significant. Therefore, the author believes that there does not exist a significant difference in Internet attitude scores between male teachers who do not teach math and all female teachers in this population.

The low Internet attitude scores of male math and math/science teachers are believed to be a result of this group's relatively low level of Internet use. The relationship between computer attitude and use in previous research shows that increased exposure to computer equipment and the use of computers has been found to increase attitude (Kolehmainen, 1992). Figure 5-7 depicts the levels of Internet (1) access, (2) history, (3) frequency, and (4) variety for male math teachers and other groups. It can be seen that male math teachers had lower score for all Internet use variables. Means scores for this figure are presented in Table 5-1. Based upon these findings, the author believes that low Internet attitude scores for this group are related to low level of Internet use.

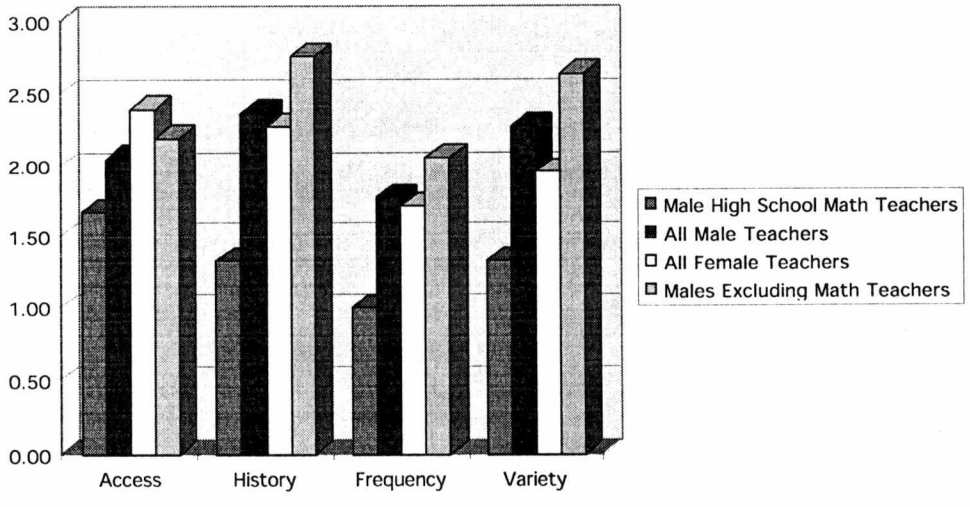

Figure 5-7. Internet Use Variables of Male Math Teachers

Table 5-1. Mean Scores of Gender Groups and Internet Use Variables

Gender Group	Internet Access	Internet History	Internet Frequency	Internet Variety
Male Math Teachers	1.67	1.33	1.00	1.33
All Male Teachers	2.05	2.36	1.77	2.27
All Female Teachers	2.39	2.27	1.71	1.96
Males Excluding Math Teachers	2.19	2.75	2.06	2.63

Implications

This section explores implications that can be drawn from the results of this study, connecting the need for this study with the research results. Implications of this study will concentrated on how the results of this study impact the literature of (1) technology adoption in schools, (2) innovativeness research, and (3) computer attitude research. Each of these areas is explored in further detail in the subsequent sections.

Technology Adoption in Schools

Implications of this study in the field of instructional technology center on the impact of the results on technology adoption in school systems. As mentioned in the need for this study, the development of a telecommunications infrastructure within public schools is presently receiving vast sums of funding. However, results from the research in the field reveals little with regard to the adoption process of these technologies in K-12 teacher populations. The few experimental studies that exist focus primarily on the adoption of instructional media and technology in populations of technology coordinators, computer teachers, media specialists, and librarians (e.g., Finlay & Finlay, 1996; Huang,

1993). As expressed by Geoghegan (1994), this group of early adopters have frequently prevented the technology adoption of mainstream faculty through the advocacy of models that are largely irrelevant to the needs and skills of the majority of adopters. Making implementation and training decisions based upon the findings of studies focusing on these groups is questionable, in relation to the adoption of technologies within the general K-12 teaching population of most public school systems.

From research on computer attitude and faculty technology training it is shown that training increases the use of computers and technology. This change in use pattern is a result of teachers' increased confidence level in the use of computers and technology (Standish, 1993). Studies in consumer research (Robertson, 1971) further show that changes in an individual's attitude toward a product directly relate to subsequent behavioral change toward its use. These areas of research provide insight into the relationship between experience, attitude, and subsequent product use.

Studies in the diffusion of innovations reveal that the innovators' importance in research is related to their speed of adopting new ideas, and the influence this group has on the subsequent adoption of an idea by members of other adopter groups. In educational institutions, innovators have been identified as those who search for technological breakthroughs in instructional methods (Geoghegan, 1994). The review of related research indicates a positive relationship between innovativeness and specific demographic characteristics, personality characteristics, attitude toward technology, and a relationship between innovativeness and attitude toward the innovation.

Findings from this study corroborate previous research on innovativeness and attitude studies in three ways: (1) the attitudes toward the use of the Internet for innovative teachers are significantly more favorable than those of both majority members and laggards; (2) innovators and majority members have used the Internet, while laggards have exhibited little Internet use; and (3) there exists a significant positive relationship between increased favorable attitudes toward using the Internet and an increase in teachers' Internet use.

The impact on the adoption of technology in schools is the dual importance of positive attitudes and innovator adoption in ensuring a successful integration of new technologies. Based upon findings in diffusion theory (Rogers, 1995), innovators are the first to adopt new ideas. Their adoption of ideas preceeds and influences the adoption decision of the majority and laggard groups. The innovators in a school population, therefore, are the ones who will influence the adoption of new instructional technologies by other groups.

The laggards of the population also play an important role, since they influence the ultimate universal acceptance of any new technology. For instance, as a school-wide communication system, e-mail is only useful if everyone uses the technology. Rogers (1995) explains the role of later adopters in his idea of "discontinuance" of a interactive innovation, whereas the discontinuance of one individual with using e-mail for communicating could ultimately lead to a critical mass of discontinuers. The viability of such an innovation depends upon its ultimate adoption by everyone in the population. If there is a movement of discontinuers, with respect to e-mail in a school system, the innovation would no

longer be an effective means of communicating with all members of the school system.

Training is an important way to provide late majority and laggard adopters with experience using technology; thereby increasing attitude toward the innovation, and increasing subsequent use. Additional considerations, with respect to increasing Internet use in late adopter groups, would be to demonstrate a need for Internet use and to focus on instructional improvement related to the use of the Internet, rather than on the Internet technology itself.

Innovativeness Studies

It is important for researchers to record variables such as attitudes, usage measures, personality types, and demographic variables as new technology innovations are introduced into the teaching population. The lack of uniform Internet access within specific school buildings and throughout entire school systems has been an obstacle to measuring such variables in relation to the Internet. However, the Springfield School System was capable of providing the researcher with data on teachers who all have access to the Internet, and who have been provided with training on Internet use.

Results of descriptive statistics, hypotheses testing, and additional findings were reported previously. These findings largely disagree with the majority of studies (Rogers, 1995) in diffusion research, with respect to demographic variables often associated with innovators: (1) level of education, (2) age, and (3) annual household income. In this study, no significant differences were found with respect to level of education or annual household income, variables which

traditionally have increased with level of innovativeness. However, belonging to a younger age group in this study was found to be related to an increase in innovativeness.

An important result of examining independent variables with innovativeness in this study was the examination of the additional demographic and teacher-specific variables: (1) gender, and (2) subject area. It was shown that significant differences exist in this population with respect to both of these variables. In particular, it was reported that (1) female teachers in this population had significantly higher innovativeness scores than male teachers, and (2) the general subject teacher group had significantly higher innovativeness scores than the math and science teacher group. However, the difference in innovativeness scores between male and female teachers and within subject areas in this school system are both related to the mean scores of male math teachers which are significantly lower than both male teachers who do not teach math, and all female teachers.

Internet Attitude Studies

Positive attitudes toward product usage have been reported to be associated with subsequent adoption and use (Achenbaum, 1966; Robertson, 1971). Studies in education (Davidson & Richie, 1994) link teachers' positive computer attitude with effective implemented into the classroom. In order to understand the ultimate adoption of Internet technologies in schools, it is necessary to assess the attitude of teachers toward their use of the Internet. At the onset of this study, a review of the literature failed to uncover an appropriate scale for measuring

attitude toward the use of the Internet. One of the research goals, therefore, was the development of a valid and reliable Internet attitude scale.

The researcher created a twelve-item scale for this construct, named the Internet Attitude Scale, designed to measure the cognitive, behavioral, and affective domains of attitude. The establishment of validity for the scale followed the review of a wide range of attitude measures in the literature. The help of colleagues was solicited to suggest new ideas and help clarify the wording of the initial group of statements. These statements were then presented to an international group of students, researchers, and practitioners in a variety of fields related to the research. The objective of this content review was to assess and suggest changes to each item, and to rate the most appropriate items in each section of the scale. As a result of the content review, the Internet Attitude Scale was modified to include a total of twelve statements: five items related to the cognitive domain, three items for behavioral, and four items in respect to the affective domain of attitude.

Reliability was determined with a pretest of the scale in a sample of 131 teacher education students at the University of Tennessee, Knoxville in October 1997. The Guttman split-half technique was used on the data to test the internal consistency of the scale. The twelve-item scale produced a high coefficient of .85, indicating a strong degree of correspondence between individual scale items. Internal consistency of the scale was also tested on the data set for this study, this measure resulted in a similar high coefficient of .89. One of the implications of this study, then, was the development of the Internet Attitude Scale. This instrument has been determined to be a valid and reliable scale for assessing attitude

toward the use of the Internet, useful for facilitating comparative and accumulative research in Internet atttiude measures in many diciplines.

Suggestions for Further Research

The limitations of this study are that there is a limited knowledge of (1) the adoption process and communication system in the school system, (2) the effects of Internet training on subsequent use, and (3) the use of the Internet for educational use. Three suggestions are made to address the limitations, pertaining to the continuation of research in the areas of innovativeness, Internet attitude, and Internet use in the K-12 teacher population. These suggestions involve (1) the employment of alternative methods for identifying innovators, (2) the administering of a treatment group study, and (3) the design of a similar research study which focuses specifically on educational uses of the Internet. These suggestions are each discussed further in the following sections.

Methods of Identifying Innovators

This study focused on the relationship between Internet attitude and Internet use on teachers' level of innovativeness in the Springfield School System. To measure innovativeness, the researcher employed the use of a self-report measure, the Innovativeness Scale (Hurt, Joseph, & Cook, 1977). This measure gauges the normally distributed personality trait, "willingness to change", which contributes to the adoption or rejection of new ideas (Goldsmith, 1986). The self-report method used in this study asked respondents to rate statements as to the extent to which they regard themselves to be innovative.

Future studies could employ alternative methods of identifying innovators in a teaching population. The three primary alternative methods are: (1) socio-metric methods, where members of a group are asked to whom they refer for advice and information about new ideas; (2) informants' ratings, where key members of the group are asked to point out the most innovative members; and (3) observation techniques, where the researcher could identify and record the network of innovation communication as it occurs. These methods would help demonstrate the rate of adoption of new technologies, and illuminate existing communication channels in the school system.

Treatment Group Studies

An experimental pretest-posttest control group or repeated measures research design could be employed to determine the effects of various types of technology training on specific adopter types. Measures of innovativeness could be taken in advance of training. Adopter types would then be assigned to a specific type of training technique.

Mean scores after treatment would be analyzed for differences between adopter types and treatment. It could then be determined what specific types of training benefit each type of adopter category.

Educational Internet Use

Measures of Internet use in this study were limited to overall use, not specific to educational use. This study could be modified to pertain specifically to educational use of the Internet. Teachers would report use of the Internet only in the areas in which it impacts their teaching and professional development.

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APPENDICES

APPENDIX A.

Research Instrument

College of Education
316 Claxton Addition
Knoxville, TN 37996

phone: (423) 974-0910
email: pwallace@utk.edu

December 12, 1997

My name is Paul Wallace and I am a doctoral student at The University of Tennessee College of Education studying Instructional Technology. I am currently researching the attitude teachers have toward the use of the Internet and a personality trait known as "innovativeness".

Attached to this letter is a survey that will measure these attributes, as well as gathering information about your Internet use and demographics. Please take a few minutes to complete and return this questionnaire, it should take no more than ten minutes.

The results of this study will lead to the development of technology training strategies, help determine the relationship between Internet attitude and subsequent use in the teacher population of this school system, and lead to the development of a valid and reliable scale for the measure of an individual's attitude toward the use of the Internet.

Your participation in this study is voluntary; you may refuse to participate or withdraw from participation at any time without penalty. Your return of the attached survey constitutes consent to participate. The information you provide is anonymous and strictly confidential. All data will be kept confidential and stored in a secure location by the researcher for further analysis.

When the results are presented, data from this study will be reported only in the form of group results. Summary results of the study will be released to participants upon request.

If you have any questions about this study, please contact me at (423) 974-0910 or via email: pwallace@utk.edu.

Sincerely,

Paul R. Wallace

Section 1. Innovativeness Scale

For each of the following statements, please indicate the extent to which you agree or disagree with the ideas expressed. Please circle the number that corresponds to how you feel about the statement.

	strongly disagree			neutral			strongly agree
My peers often ask me for advice or information.	1	2	3	4	5	6	7
I enjoy trying out new ideas.	1	2	3	4	5	6	7
I seek out new ways to do things.	1	2	3	4	5	6	7
I am generally cautious about accepting new ideas.	1	2	3	4	5	6	7
I frequently improvise methods for solving problems when an answer is not apparent.	1	2	3	4	5	6	7
I am suspicious of new inventions and new ways of thinking.	1	2	3	4	5	6	7
I rarely trust new ideas until I can see whether the vast majority of people around me accept them.	1	2	3	4	5	6	7
I feel that I am an influential member of my peer group.	1	2	3	4	5	6	7
I consider myself to be creative and original in my thinking and behavior.	1	2	3	4	5	6	7
I am aware that I am usually one of the last people in my group to accept something new.	1	2	3	4	5	6	7
I am an inventive kind of person.	1	2	3	4	5	6	7
I enjoy taking part in the leadership responsibilities of the groups I belong to.	1	2	3	4	5	6	7
I am reluctant about adopting new ways of doing things until I see them working for people around me.	1	2	3	4	5	6	7
I find it stimulating to be original in my thinking and behavior.	1	2	3	4	5	6	7
I tend to feel that the old way of living and doing things is the best way.	1	2	3	4	5	6	7
I am challenged by ambiguities and unsolved problems.	1	2	3	4	5	6	7
I must see people using new innovations before I will consider them.	1	2	3	4	5	6	7
I am receptive to new ideas.	1	2	3	4	5	6	7
I am challenged by unanswered questions.	1	2	3	4	5	6	7
I often find myself skeptical of new ideas.	1	2	3	4	5	6	7

Section 2. Attitude Toward Using the Internet

For each of the following statements, please indicate the extent to which you agree or disagree with the ideas expressed. Please circle the number that corresponds to how you feel about the statement.

	strongly disagree			neutral			strongly agree
I feel that using the Internet is necessary in this day and age.	1	2	3	4	5	6	7
Learning about the different uses of the Internet is interesting.	1	2	3	4	5	6	7
The Internet can be a useful tool in my work.	1	2	3	4	5	6	7
Using the Internet will probably be an important part of my future.	1	2	3	4	5	6	7
I can see the importance of using the Internet in my life.	1	2	3	4	5	6	7
I look forward to using the Internet.	1	2	3	4	5	6	7
I would like to spend more time using the Internet.	1	2	3	4	5	6	7
I would like to learn more about using the Internet.	1	2	3	4	5	6	7

Place a check in the blank closest to the word on each line that describes how you feel about using the Internet.

Excited	__ : __ : __ : __ : __ : __ : __	Unexcited
Involved	__ : __ : __ : __ : __ : __ : __	Uninvolved
Interested	__ : __ : __ : __ : __ : __ : __	Uninterested
Comfortable	__ : __ : __ : __ : __ : __ : __	Uncomfortable

Section 3. Internet Experience

1. I have access to the Internet... (check all that apply)

__home
__work
__public library
__college or universtiy campus
__other _____
__I have no access to the Internet

2. From which one of the following locations do you most frequently use the Internet? (check only one)

__home __college or universtiy campus
__work __other _____
__public library __I have never used the Internet (if checked, skip to section 4)

If you answered I have never used the Internet to the above question, skip to Section 4. Otherwise, please answer the following questions about your Internet use.

3. How long have you been using the Internet?

__0 - 6 months
__7 - 12 months
__13 - 35 months
__36 + months

4. Approximately how many hours per week do you spend using the Internet?

__less than 1 hour
__more than 1 but less than 4 hours
__more than 4 but less than 10 hours
__10 hours or more

5. I use the following Internet tools...(check all that apply)

__World Wide Web __Newsgroups/Usenet
__E-mail __Gopher
__FTP __Netcasting/Push
__IRC/Chat __other _____

Section 4. Demographic Data

6. Are you...

__male __female

7. What grade level do you teach? _____

8. What subject area do you teach? _____

9. How many years have you been teaching? _____

10. What is the highest level of formal education you have completed?

__ some college
__ bachelor's degree
__ some graduate work
__ master's degree
__ educational specialist degree
__ doctoral or professional degree (Ph.D., M.D., etc.)

11. What is your age?

__ 20 - 29 years
__ 30 - 39 years
__ 40 - 49 years
__ 50 - 59 years
__ 60 - 70 years
__ 70+ years

12. What was your total household income before taxes for the current calendar year?

__ less than $25,000
__ $25,000 - $50,000
__ $50,000 - $75,000
__ $75,000 - $100,000
__ more than $100,000

APPENDIX B.

Innovativeness Scale (Hurt, Joseph, & Cook, 1977)

Section 1. Innovativeness Scale

For each of the following statements, please indicate the extent to which you agree or disagree with the ideas expressed. Please circle the number that corresponds to how you feel about the statement.

	strongly disagree			neutral			strongly agree
My peers often ask me for advice or information.	1	2	3	4	5	6	7
I enjoy trying out new ideas.	1	2	3	4	5	6	7
I seek out new ways to do things.	1	2	3	4	5	6	7
I am generally cautious about accepting new ideas.	1	2	3	4	5	6	7
I frequently improvise methods for solving problems when an answer is not apparent.	1	2	3	4	5	6	7
I am suspicious of new inventions and new ways of thinking.	1	2	3	4	5	6	7
I rarely trust new ideas until I can see whether the vast majority of people around me accept them.	1	2	3	4	5	6	7
I feel that I am an influential member of my peer group.	1	2	3	4	5	6	7
I consider myself to be creative and original in my thinking and behavior.	1	2	3	4	5	6	7
I am aware that I am usually one of the last people in my group to accept something new.	1	2	3	4	5	6	7
I am an inventive kind of person.	1	2	3	4	5	6	7
I enjoy taking part in the leadership responsibilities of the groups I belong to.	1	2	3	4	5	6	7
I am reluctant about adopting new ways of doing things until I see them working for people around me.	1	2	3	4	5	6	7
I find it stimulating to be original in my thinking and behavior.	1	2	3	4	5	6	7
I tend to feel that the old way of living and doing things is the best way.	1	2	3	4	5	6	7
I am challenged by ambiguities and unsolved problems.	1	2	3	4	5	6	7
I must see people using new innovations before I will consider them.	1	2	3	4	5	6	7
I am receptive to new ideas.	1	2	3	4	5	6	7
I am challenged by unanswered questions.	1	2	3	4	5	6	7
I often find myself skeptical of new ideas.	1	2	3	4	5	6	7

APPENDIX C.

Internet Attitude Scale

Section 2. Attitude Toward Using the Internet

For each of the following statements, please indicate the extent to which you agree or disagree with the ideas expressed. Please circle the number that corresponds to how you feel about the statement.

	strongly disagree			neutral			strongly agree
I feel that using the Internet is necessary in this day and age.	1	2	3	4	5	6	7
Learning about the different uses of the Internet is interesting.	1	2	3	4	5	6	7
The Internet can be a useful tool in my work.	1	2	3	4	5	6	7
Using the Internet will probably be an important part of my future.	1	2	3	4	5	6	7
I can see the importance of using the Internet in my life.	1	2	3	4	5	6	7
I look forward to using the Internet.	1	2	3	4	5	6	7
I would like to spend more time using the Internet.	1	2	3	4	5	6	7
I would like to learn more about using the Internet.	1	2	3	4	5	6	7

Place a check in the blank closest to the word on each line that describes how you feel about using the Internet.

Excited	__ : __ : __ : __ : __ : __ : __	Unexcited
Involved	__ : __ : __ : __ : __ : __ : __	Uninvolved
Interested	__ : __ : __ : __ : __ : __ : __	Uninterested
Comfortable	__ : __ : __ : __ : __ : __ : __	Uncomfortable

APPENDIX D.

Internet Attitude Scale Content Review

	Responses	Percent	Remain in Scale
Cognitive Domain			
Using the Internet will be important to me in my career.	4	8	
Anything that the Internet can be used for, I can do just as well in another way.	8	16	
People who use the Internet are seen as being more important than those who don't.	8	16	
I feel that using the Internet is necessary in this day and age.	42	82	*
Using the Internet is a waste of time.	10	20	
Learning about the different uses of the Internet is interesting.	33	65	*
The Internet can be a useful tool in my work.	37	73	*
Using the Internet will probably be an important part of my future.	43	84	*
I can see the importance of using the Internet in my life.	43	84	*
The Internet is too complicated for me to use.	7	14	
Behavioral Domain			
I look forward to using the Internet.	38	75	*
If I can, I will attend workshops to learn more about using the Internet.	16	31	
If I need Internet skills at work, I will develop them.	21	41	
I would like to spend more time using the Internet.	29	57	*
I will probably never learn how to use the Internet.	9	18	
I see the Internet as something that I will rarely use.	14	27	
I would like to learn more about using the Internet.	29	57	*
I avoid the Internet because it is unfamiliar to me.	8	16	
If I had access to the Internet, I would use it.	9	18	
I will begin to use the Internet as soon as possible.	3	6	

	Responses	Percent	Remain in Scale
Affective Domain			
Excited/Fearful	30	59	*
Secure/Concerned	19	37	
Involved/Apathetic	15	29	
Eager/Apprehensive	25	49	*
Interested/Indifferent	36	71	*
Anticipation/Dread	5	10	
Confident/Nervous	25	49	
Comfortable/Worried	24	47	*
Proficient/Incompetent	20	39	
Impatient/Timid	6	12	

APPENDIX E.

Internet Use Questions

Section 3. Internet Experience

1. I have access to the Internet... (check all that apply)

__home __college or universtiy campus
__work __other_____
__public library __I have no access to the Internet

2. From which one of the following locations do you most frequently use the Internet? (check only one)

__home __college or universtiy campus
__work __other_____
__public library __I have never used the Internet (if checked, skip to section 4)

If you answered I have never used the Internet to the above question, skip to Section 4. Otherwise, please answer the following questions about your Internet use.

3. How long have you been using the Internet?

__0 - 6 months
__7 - 12 months
__13 - 35 months
__36 + months

4. Approximately how many hours per week do you spend using the Internet?

__less than 1 hour
__more than 1 but less than 4 hours
__more than 4 but less than 10 hours
__10 hours or more

5. I use the following Internet tools...(check all that apply)

__World Wide Web __Newsgroups/Usenet
__E-mail __Gopher
__FTP __Netcasting/Push
__IRC/Chat __other_____

APPENDIX F.

Demographic Questions

Section 4. Demographic Data

6. Are you...

__male __female

7. What grade level do you teach? _____

8. What subject area do you teach? _____

9. How many years have you been teaching? _____

10. What is the highest level of formal education you have completed?

__some college
__bachelor's degree
__some graduate work
__master's degree
__educational specialist degree
__doctoral or professional degree (Ph.D., M.D., etc.)

11. What is your age?

__20 - 29 years
__30 - 39 years
__40 - 49 years
__50 - 59 years
__60 - 70 years
__70+ years

12. What was your total household income before taxes for the current calendar year?

__less than $25,000
__$25,000 - $50,000
__$50,000 - $75,000
__$75,000 - $100,000
__more than $100,000

APPENDIX G.

Instrument Reliability Testing

Table G-1. Pre-Test Reliability Scores for the Full Internet Attitude Scale

Item-total Statistics:

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted
A01	129.9237	288.1480	.6856	.8852
A02	130.9847	297.5844	.3575	.8916
A03	132.4122	316.2749	-.0704	.9044
A04	130.4427	287.3563	.5464	.8873
A05	129.7023	292.4107	.5253	.8881
A06	129.9313	285.0645	.6882	.8845
A07	129.7099	289.1460	.6922	.8853
A08	129.9847	286.2921	.6956	.8847
A09	130.0305	283.1837	.7390	.8835
A10	130.2214	287.6660	.5240	.8879
A11	130.3053	277.3522	.7598	.8820
A12	131.2519	293.2053	.3648	.8921
A13	129.8015	295.5757	.5111	.8887
A14	130.4733	280.1281	.6839	.8838
A15	129.3435	295.0580	.4643	.8894
A16	129.7710	286.4548	.7510	.8841
A17	130.0916	289.4685	.6362	.8861
A18	130.0840	275.9390	.6699	.8838
A19	133.7786	341.2352	-.6790	.9095
A20	133.3740	350.6513	-.7305	.9151
A21	130.2290	283.7779	.6821	.8844
A22	131.2061	283.6110	.5976	.8860
A23	130.7939	281.1649	.6794	.8841
A24	129.8473	288.3611	.6582	.8856
A25	130.9771	283.8072	.5692	.8867
A26	130.7481	282.9130	.6408	.8850

Reliability Coefficients:

N of Cases = 131.0	N of Items = 26
Correlation between forms = .6898	Equal-length Spearman-Brown = .8164
Guttman Split-half = .8133	Unequal-length Spearman-Brown = .8164
13 Items in part 1	13 Items in part 2
Alpha for part 1 = .8565	Alpha for part 2 = .7863

Table G-2. Pre-Test Reliability Scores for the Short Internet Attitude Scale

Item-total Statistics:

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted
A04	61.6565	107.2734	.5047	.9176
A06	61.1450	103.4173	.7557	.9063
A07	60.9237	107.2711	.7045	.9092
A08	61.1985	106.0372	.6821	.9096
A09	61.2443	104.2783	.7207	.9078
A11	61.5191	99.0823	.8074	.9032
A14	61.6870	100.5090	.7361	.9068
A17	61.3053	106.6753	.6816	.9097
A21	61.4427	103.4332	.7119	.9080
A24	61.0611	106.5347	.6791	.9098
A25	62.1908	106.5402	.4785	.9199
A26	61.9618	105.0985	.5812	.9141

Reliability Coefficients:

N of Cases = 131.0 — N of Items = 12

Correlation between forms = .7333 — Equal-length Spearman-Brown = .8462

Guttman Split-half = .8462 — Unequal-length Spearman-Brown = .8462

6 Items in part 1 6 — Items in part 2

Alpha for part 1 = .8882 — Alpha for part 2 = .8490

Table G-3. Reliability Scores for the Innovativeness Scale in this Study

Item-total Statistics:

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted
IN01	103.2740	483.3683	.6342	.9647
IN02	102.8767	473.5540	.8175	.9627
IN03	103.0137	478.8470	.7508	.9635
IN04	104.1370	472.2310	.6101	.9657
IN05	103.1233	487.7207	.6244	.9648
IN06	103.4247	470.7477	.7356	.9636
IN07	103.3014	471.8524	.7543	.9634
IN08	103.4384	483.3052	.6782	.9642
IN09	103.3288	466.7793	.7854	.9630
IN10	102.9452	476.1358	.8052	.9629
IN11	103.6164	466.5731	.8004	.9628
IN12	103.3836	463.8231	.7534	.9635
IN13	103.3973	463.7150	.8601	.9620
IN14	103.1233	467.9707	.8789	.9619
IN15	103.6438	477.6769	.7109	.9639
IN16	103.6986	478.4079	.6956	.9640
IN17	103.4795	465.5586	.8512	.9622
IN18	102.9863	472.6526	.8548	.9623
IN19	103.4110	470.0788	.8306	.9625
IN20	103.7534	471.7995	.6552	.9648

Reliability Coefficients:

N of Cases = 73.0 N of Items = 20

Correlation between forms = .9332 Equal-length Spearman-Brown = .9655

Guttman Split-half = .9615 Unequal-length Spearman-Brown = .9655

10 Items in part 1 10 Items in part 2

Alpha for part 1 = .9173 Alpha for part 2 = .9459

Table G-4. Reliability Scores for the Internet Attitude Scale in this Study

Item-total Statistics:

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted
A01	61.8904	174.0712	.7095	.9317
A02	61.6164	176.2675	.7535	.9304
A03	61.5342	171.6412	.8214	.9277
A04	61.5753	172.9977	.7691	.9295
A05	61.5753	173.1088	.8239	.9279
A06	61.5068	174.0868	.8228	.9281
A07	61.6849	172.4688	.7326	.9308
A08	61.3288	182.0571	.5957	.9355
A09	61.8082	170.8794	.7719	.9293
A10	62.0685	172.7869	.6089	.9367
A11	61.4384	176.7496	.7542	.9304
A12	62.1370	173.2588	.5774	.9385

Reliability Coefficients:

N of Cases = 73.0	N of Items = 12
Correlation between forms = .8033	Equal-length Spearman-Brown = .8909
Guttman Split-half = .8909	Unequal-length Spearman-Brown = .8909
6 Items in part 1	6 Items in part 2
Alpha for part 1 = .9311	Alpha for part 2 = .8564

Table G-5. Reliability Scores for Combined Internet Use in this Study

Item-total Statistics:

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted
IE01	6.0822	10.5208	.6390	.8710
IE03	6.0685	8.3425	.7789	.8176
IE04	6.6438	9.8158	.7901	.8206
IE05	6.3151	8.3577	.7442	.8348

Reliability Coefficients:

N of Cases = 73.0	N of Items = 4
Correlation between forms = .7936	Equal-length Spearman-Brown = .8850
Guttman Split-half = .8845	Unequal-length Spearman-Brown = .8850
2 Items in part 1	2 Items in part 2
Alpha for part 1 = .7201	Alpha for part 2 = .8000

APPENDIX H.

Human Subjects Form

I N T E R
College of Education
O F F I C E

MEMO

To: ✓ Mr. Paul Wallace
316 Claxton Addition

Dr. Lonnie McIntyre
415 Claxton Addition

From: Dr. Carol Kasworm

Date: February 11, 1998

Subject: Approval of Form A Review - Use of Human Subjects in Research

---

The College Committee for Research has received and approved your Form A request for: "Relationship between Teachers' innovativeness, attitude toward the use of the Internet, and Internet Use."

Attached is the signed permission form. If you have any questions, please do feel free to contact me at (423)974-2272.

I wish you success in your research activities.

c: Ms. Brenda Lawson
Office of Compliance

APPENDIX I.

Descriptive Statistics

Table I-1. Frequency Measures for the Innovativeness Scale

Innovativeness Scale

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	29.00	1	1.4	1.4	1.4
	40.00	1	1.4	1.4	2.7
	42.00	1	1.4	1.4	4.1
	66.00	1	1.4	1.4	5.5
	77.00	1	1.4	1.4	6.8
	80.00	2	2.7	2.7	9.6
	81.00	1	1.4	1.4	11.0
	82.00	1	1.4	1.4	12.3
	87.00	1	1.4	1.4	13.7
	90.00	1	1.4	1.4	15.1
	92.00	1	1.4	1.4	16.4
	94.00	1	1.4	1.4	17.8
	95.00	1	1.4	1.4	19.2
	96.00	1	1.4	1.4	20.5
	97.00	3	4.1	4.1	24.7
	98.00	2	2.7	2.7	27.4
	99.00	1	1.4	1.4	28.8
	100.00	4	5.5	5.5	34.2
	101.00	1	1.4	1.4	35.6
	103.00	1	1.4	1.4	37.0
	104.00	1	1.4	1.4	38.4
	105.00	1	1.4	1.4	39.7
	108.00	1	1.4	1.4	41.1
	109.00	2	2.7	2.7	43.8
	110.00	2	2.7	2.7	46.6
	112.00	2	2.7	2.7	49.3
	114.00	3	4.1	4.1	53.4
	115.00	4	5.5	5.5	58.9
	116.00	1	1.4	1.4	60.3
	117.00	2	2.7	2.7	63.0
	119.00	4	5.5	5.5	68.5
	120.00	1	1.4	1.4	69.9

Table I-1. (Continued)

	Frequency	Percent	Valid Percent	Cumulative Percent
121.00	2	2.7	2.7	72.6
122.00	1	1.4	1.4	74.0
123.00	2	2.7	2.7	76.7
127.00	1	1.4	1.4	78.1
128.00	1	1.4	1.4	79.5
130.00	1	1.4	1.4	80.8
131.00	1	1.4	1.4	82.2
132.00	1	1.4	1.4	83.6
133.00	1	1.4	1.4	84.9
134.00	1	1.4	1.4	86.3
135.00	3	4.1	4.1	90.4
136.00	2	2.7	2.7	93.2
137.00	1	1.4	1.4	94.5
138.00	1	1.4	1.4	95.9
139.00	2	2.7	2.7	98.6
140.00	1	1.4	1.4	100.0
Total	73	100.0	100.0	
Total	73	100.0		

Table I-2. Frequency Measures for the Internet Attitude Scale

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18.00	1	1.4	1.4	1.4
	32.00	1	1.4	1.4	2.7
	36.00	1	1.4	1.4	4.1
	38.00	1	1.4	1.4	5.5
	43.00	2	2.7	2.7	8.2
	46.00	1	1.4	1.4	9.6
	47.00	2	2.7	2.7	12.3
	51.00	1	1.4	1.4	13.7
	52.00	1	1.4	1.4	15.1
	53.00	2	2.7	2.7	17.8
	54.00	1	1.4	1.4	19.2
	56.00	2	2.7	2.7	21.9
	57.00	1	1.4	1.4	23.3
	60.00	1	1.4	1.4	24.7
	61.00	2	2.7	2.7	27.4
	62.00	2	2.7	2.7	30.1
	63.00	1	1.4	1.4	31.5
	64.00	2	2.7	2.7	34.2
	65.00	1	1.4	1.4	35.6
	66.00	3	4.1	4.1	39.7
	67.00	1	1.4	1.4	41.1
	69.00	5	6.8	6.8	47.9
	70.00	4	5.5	5.5	53.4
	71.00	2	2.7	2.7	56.2
	72.00	4	5.5	5.5	61.6
	73.00	1	1.4	1.4	63.0
	74.00	2	2.7	2.7	65.8
	75.00	2	2.7	2.7	68.5
	76.00	1	1.4	1.4	69.9
	78.00	4	5.5	5.5	75.3
	79.00	1	1.4	1.4	76.7
	81.00	3	4.1	4.1	80.8
	82.00	3	4.1	4.1	84.9
	83.00	4	5.5	5.5	90.4
	84.00	7	9.6	9.6	100.0
Total		73	100.0		

Table I-3. Measures of Central Tendency for Instrument Variables

	N		Std.				
	Valid	Missing	Deviation	Variance	Range	Minimum	Maximum
Internet Attitude	73	0	14.3762	206.6739	66.00	18.00	84.00
Innovativeness Scale	73	0	22.8757	523.2960	111.00	29.00	140.00
Adopter Type	73	0	.5774	.3333	2.00	1.00	3.00
Access to the Internet	73	0	1.0203	1.0411	5.00	.00	5.00
Location of Internet Use	73	0	1.0829	1.1728	6.00	.00	6.00
History of Internet Use	73	0	1.2876	1.6579	4.00	.00	4.00
Frequency of Internet Use	73	0	1.0036	1.0072	4.00	.00	4.00
Variety of Internet Use	73	0	1.3217	1.7470	5.00	.00	5.00
Internet Use	73	0	3.9739	15.7919	18.00	.00	18.00
Gender	73	0	.4620	.2135	1.00	1.00	2.00
Grade Level	73	0	5.8190	33.8604	16.00	1.00	17.00
Subject Area	73	0	5.2886	27.9692	18.00	1.00	19.00
Subject Area *	73	0	1.8157	3.2968	5.00	1.00	6.00
Experience	73	0	8.8276	77.9269	27.00	1.00	28.00
Teaching Experience *	73	0	1.7663	3.1199	5.00	1.00	6.00
Education	73	0	1.0913	1.1910	5.00	1.00	6.00
Education *	73	0	1.0631	1.1301	4.00	2.00	6.00
Age	73	0	.9586	.9189	4.00	1.00	5.00
Age *	73	0	.9286	.8623	3.00	1.00	4.00
Income	73	0	1.1550	1.3341	5.00	.00	5.00
Income *	70	3	.9776	.9557	3.00	1.00	4.00

* Item adjusted for testing

Table I-4. Frequency Measures for Grade Level

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Kindergarden	1	1.4	1.4	1.4
	Grades K-2	10	13.7	13.7	15.1
	Grades 3-5	12	16.4	16.4	31.5
	Grade 4	2	2.7	2.7	34.2
	Grade 5	2	2.7	2.7	37.0
	Grade 6	5	6.8	6.8	43.8
	Grade 7	3	4.1	4.1	47.9
	Grade 8	3	4.1	4.1	52.1
	Grade 9	4	5.5	5.5	57.5
	Grade 10	1	1.4	1.4	58.9
	Grade 12	1	1.4	1.4	60.3
	Special Education	3	4.1	4.1	64.4
	Grades K-5	3	4.1	4.1	68.5
	Grades 6-8	10	13.7	13.7	82.2
	Grades 6-12	1	1.4	1.4	83.6
	Grades 10-12	12	16.4	16.4	100.0
Total		73	100.0		

Table I-5. Frequency Measures for Subject Area

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	General Subjects	27	37.0	37.0	37.0
	Speech Pathology	2	2.7	2.7	39.7
	Counseling	3	4.1	4.1	43.8
	Special Education	4	5.5	5.5	49.3
	Music & Band	3	4.1	4.1	53.4
	English & Soc Studies	5	6.8	6.8	60.3
	Math and Science	4	5.5	5.5	65.8
	Library Information	1	1.4	1.4	67.1
	Social Studies	3	4.1	4.1	71.2
	Arts	2	2.7	2.7	74.0
	History	2	2.7	2.7	76.7
	Math	8	11.0	11.0	87.7
	Science	1	1.4	1.4	89.0
	English	3	4.1	4.1	93.2
	Health	1	1.4	1.4	94.5
	Accounting	1	1.4	1.4	95.9
	Career Development	1	1.4	1.4	97.3
	Geography	1	1.4	1.4	98.6
	Biology	1	1.4	1.4	100.0
Total		73	100.0		

Table I-6. Frequency Measures for Years of Experience

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	8	11.0	11.0	11.0
	2.00	3	4.1	4.1	15.1
	3.00	1	1.4	1.4	16.4
	4.00	3	4.1	4.1	20.5
	5.00	4	5.5	5.5	26.0
	6.00	3	4.1	4.1	30.1
	7.00	3	4.1	4.1	34.2
	8.00	1	1.4	1.4	35.6
	9.00	1	1.4	1.4	37.0
	10.00	5	6.8	6.8	43.8
	11.00	1	1.4	1.4	45.2
	12.00	5	6.8	6.8	52.1
	13.00	2	2.7	2.7	54.8
	15.00	1	1.4	1.4	56.2
	16.00	4	5.5	5.5	61.6
	17.00	3	4.1	4.1	65.8
	19.00	2	2.7	2.7	68.5
	20.00	3	4.1	4.1	72.6
	21.00	2	2.7	2.7	75.3
	23.00	5	6.8	6.8	82.2
	24.00	3	4.1	4.1	86.3
	25.00	1	1.4	1.4	87.7
	26.00	4	5.5	5.5	93.2
	27.00	3	4.1	4.1	97.3
	28.00	2	2.7	2.7	100.0
	Total	73	100.0	100.0	
Total		73	100.0		

APPENDIX J.

Hypotheses Tests

Table J-1. Tukey Post-Hoc Test for Adopter Type and Internet Attitude

Multiple Comparisons

Dependent Variable: Internet Attitude

Tukey HSD

(I) Adopter Type	(J) Adopter Type	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Laggard	Majority	-18.0833*	3.602	.000	-26.7081	-9.4586
	Innovator	-31.7500*	4.565	.000	-42.6819	-20.8181
Majority	Laggard	18.0833*	3.602	.000	9.4586	26.7081
	Innovator	-13.6667*	3.602	.001	-22.2914	-5.0419
Innovator	Laggard	31.7500*	4.565	.000	20.8181	42.6819
	Majority	13.6667*	3.602	.001	5.0419	22.2914

*. The mean difference is significant at the .05 level.

Table J-2. Tukey Post-Hoc Test for Adopter Type and Internet Use Variables

Multiple Comparisons

Tukey HSD

Dependent Variable	(I) Adopter Type	(J) Adopter Type	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
History of Internet Use	Laggard	Majority	-1.1173*	.382	.013	-2.0325	-.2022
		Innovator	-1.8333*	.484	.001	-2.9933	-.6734
	Majority	Laggard	1.1173*	.382	.013	.2022	2.0325
		Innovator	-.7160	.382	.154	-1.6311	.1992
	Innovator	Laggard	1.8333*	.484	.001	.6734	2.9933
		Majority	.7160	.382	.154	-.1992	1.6311
Frequency of Internet Use	Laggard	Majority	-.9626*	.294	.005	-1.6664	-.2588
		Innovator	-1.5000*	.373	.000	-2.3921	-.6079
	Majority	Laggard	.9626*	.294	.005	.2588	1.6664
		Innovator	-.5374	.294	.168	-1.2412	.1664
	Innovator	Laggard	1.5000*	.373	.000	.6079	2.3921
		Majority	.5374	.294	.168	-.1664	1.2412
Variety of Internet Use	Laggard	Majority	-.7279	.411	.186	-1.7110	.2552
		Innovator	-1.4167*	.520	.022	-2.6627	-.1706
	Majority	Laggard	.7279	.411	.186	-.2552	1.7110
		Innovator	-.6888	.411	.221	-1.6719	.2943
	Innovator	Laggard	1.4167*	.520	.022	.1706	2.6627
		Majority	.6888	.411	.221	-.2943	1.6719

*. The mean difference is significant at the .05 level.

Table J-3. Tukey Post-Hoc Test for Age and Innovativeness

Multiple Comparisons

Dependent Variable: Innovativeness Scale

Tukey HSD

(I) Age	(J) Age	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
20-29	30-39	1.0357	7.512	.999	-18.7420	20.8134
	40-49	15.2212	6.942	.135	-3.0546	33.4970
	50 and over	24.9107	9.554	.053	-.2439	50.0653
30-39	20-29	-1.0357	7.512	.999	-20.8134	18.7420
	40-49	14.1855	6.183	.109	-2.0927	30.4636
	50 and over	23.8750*	9.018	.048	.1321	47.6179
40-49	20-29	-15.2212	6.942	.135	-33.4970	3.0546
	30-39	-14.1855	6.183	.109	-30.4636	2.0927
	50 and over	9.6895	8.549	.670	-12.8177	32.1967
50 and over	20-29	-24.9107	9.554	.053	-50.0653	.2439
	30-39	-23.8750*	9.018	.048	-47.6179	-.1321
	40-49	-9.6895	8.549	.670	-32.1967	12.8177

*. The mean difference is significant at the .05 level.

APPENDIX K.

Additional Findings

Table K-1. Gender and Innovativeness Analysis of Variance

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Innovativeness Scale	Between Groups	3740.752	1	3740.752	7.826	.007
	Within Groups	33936.563	71	477.980		
	Total	37677.315	72			

Table K-2. Subject and Innovativeness Analysis of Variance

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Innovativeness Scale	Between Groups	5550.897	5	1110.179	2.315	.053
	Within Groups	32126.418	67	479.499		
	Total	37677.315	72			

Table K-3. Tukey Post-Hoc Test for Subject and Innovativeness

Multiple Comparisons

Dependent Variable: Innovativeness Scale

Tukey HSD

(I) Subject Area	(J) Subject Area	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
General/Elementary	Math/Science	22.0000*	7.168	.035	.9714	43.0286
	English/Lang Arts	15.1429	8.779	.521	-10.6118	40.8975
	Soc Studies/Health	5.0179	8.779	.993	-20.7368	30.7725
	Music/Art	-2.6571	10.631	1.000	-33.8476	28.5333
	Counseling/Special Ed	7.9429	8.067	.921	-15.7241	31.6098
Math/Science	General/Elementary	-22.0000*	7.168	.035	-43.0286	-.9714
	English/Lang Arts	-6.8571	9.705	.981	-35.3300	21.6157
	Soc Studies/Health	-16.9821	9.705	.505	-45.4550	11.4907
	Music/Art	-24.6571	11.408	.270	-58.1272	8.8129
	Counseling/Special Ed	-14.0571	9.066	.633	-40.6565	12.5422
English/Lang Arts	General/Elementary	-15.1429	8.779	.521	-40.8975	10.6118
	Math/Science	6.8571	9.705	.981	-21.6157	35.3300
	Soc Studies/Health	-10.1250	10.949	.939	-42.2467	21.9967
	Music/Art	-17.8000	12.483	.711	-54.4244	18.8244
	Counseling/Special Ed	-7.2000	10.387	.982	-37.6733	23.2733
Soc Studies/Health	General/Elementary	-5.0179	8.779	.993	-30.7725	20.7368
	Math/Science	16.9821	9.705	.505	-11.4907	45.4550
	English/Lang Arts	10.1250	10.949	.939	-21.9967	42.2467
	Music/Art	-7.6750	12.483	.990	-44.2994	28.9494
	Counseling/Special Ed	2.9250	10.387	1.000	-27.5483	33.3983
Music/Art	General/Elementary	2.6571	10.631	1.000	-28.5333	33.8476
	Math/Science	24.6571	11.408	.270	-8.8129	58.1272
	English/Lang Arts	17.8000	12.483	.711	-18.8244	54.4244
	Soc Studies/Health	7.6750	12.483	.990	-28.9494	44.2994
	Counseling/Special Ed	10.6000	11.994	.949	-24.5876	45.7876
Counseling/Special Ed	General/Elementary	-7.9429	8.067	.921	-31.6098	15.7241
	Math/Science	14.0571	9.066	.633	-12.5422	40.6565
	English/Lang Arts	7.2000	10.387	.982	-23.2733	37.6733
	Soc Studies/Health	-2.9250	10.387	1.000	-33.3983	27.5483
	Music/Art	-10.6000	11.994	.949	-45.7876	24.5876

*. The mean difference is significant at the .05 level.

Table K-4. Grade Level and Innovativeness Analysis of Variance

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Innovativeness Score	Between Groups	1407.423	2	703.711	1.358	.264
	Within Groups	36269.892	70	518.141		
	Total	37677.315	72			

Table K-5. Teacher Type and Innovativeness Analysis of Variance

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Innovativeness Score	Between Groups	9207.799	2	4603.900	11.320	< .001
	Within Groups	28469.516	70	406.707		
	Total	37677.315	72			

Table K-6. Tukey Post-Hoc Test for Teacher Type and Innovativeness

Multiple Comparisons

Dependent Variable: Innovativeness Score

Tukey HSD

(I) Teacher Type	(J) Teacher Type	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Male Teachers Excluding Math	Male Math Teachers	35.3958*	9.654	.001	12.2782	58.5135
	Female Teachers	-5.9473	5.779	.561	-19.7849	7.8903
Male Math Teachers	Male Teachers Excluding Math	-35.3958*	9.654	.001	-58.5135	-12.2782
	Female Teachers	-41.3431*	8.704	.000	-62.1854	-20.5009
Female Teachers	Male Teachers Excluding Math	5.9473	5.779	.561	-7.8903	19.7849
	Male Math Teachers	41.3431*	8.704	.000	20.5009	62.1854

*. The mean difference is significant at the .05 level.

Table K-7. Gender and Internet Attitude Analysis of Variance

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Internet Attitude	Between Groups	773.395	1	773.395	3.892	.052
	Within Groups	14107.126	71	198.692		
	Total	14880.521	72			

Table K-8. Teacher Type and Internet Attitude Analysis of Variance

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Internet Attitude Score	Between Groups	2236.730	2	1118.365	6.192	.003
	Within Groups	12643.790	70	180.626		
	Total	14880.521	72			

Table K-9. Tukey Post-Hoc Test for Teacher Type and Internet Attitude

Multiple Comparisons

Dependent Variable: Internet Attitude Score

Tukey HSD

(I) Teacher Type	(J) Teacher Type	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Male Teachers Excluding Math	Male Math Teachers	18.3125*	6.434	.016	2.9064	33.7186
	Female Teachers	-2.0993	3.851	.849	-11.3209	7.1224
Male Math Teachers	Male Teachers Excluding Math	-18.3125*	6.434	.016	-33.7186	-2.9064
	Female Teachers	-20.4118*	5.801	.002	-34.3015	-6.5220
Female Teachers	Male Teachers Excluding Math	2.0993	3.851	.849	-7.1224	11.3209
	Male Math Teachers	20.4118*	5.801	.002	6.5220	34.3015

*. The mean difference is significant at the .05 level.

Table K-10. Education and Internet Attitude Analysis of Variance

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Internet Attitude	Between Groups	393.854	4	98.463	.462	.763
	Within Groups	14486.667	68	213.039		
	Total	14880.521	72			

Table K-11. Age and Internet Attitude Analysis of Variance

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Internet Attitude	Between Groups	1351.790	3	450.597	2.298	.085
	Within Groups	13528.731	69	196.069		
	Total	14880.521	72			

Table K-12. Subject and Internet Attitude Analysis of Variance

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Internet Attitude	Between Groups	1316.135	5	263.227	1.300	.274
	Within Groups	13564.386	67	202.454		
	Total	14880.521	72			

Table K-13. Grade Level and Internet Attitude Analysis of Variance

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Internet Attitude Score	Between Groups	278.725	2	139.362	.668	.516
	Within Groups	14601.796	70	208.597		
	Total	14880.521	72			

VITA

Paul Wallace holds a Bachelor of Arts degree in Philosophy and Master of Science in Curriculum and Instruction from The University of Tennessee. He has been actively engaged in the developing role of telecommunications in education since the onset of his graduate studies. Paul was employed at the University of Tennessee distance learning facilities as a video producer, a position that lead to his interest in the Internet as a vehicle for teaching and learning. He was also employed in the College of Education as an Instructor, where he taught numerous courses and workshops focusing on general computing, the Internet, multimedia, and graphic design.

During the years of his doctoral program, Paul worked as a designer and consultant specializing in interactive media development, architecture, and training. In this consulting paractice he managed the development of numerous corporate and educational interactive media projects for clients such as Eastman Chemical Company, Alltrista Corporation, Synthetic Industries, and the Perceptics Corporation.

Upon completion of the doctoral degree, Paul accepted a position at the International University of Japan as the Senior Web Architect. The International University of Japan is a highly rated international graduate school, located in the beautiful surroundings of the Japanese alps. The curriculum focuses on international relations and international development, as well as global business and global management. Here, Paul will serve as a senior member of the *System 21* team, an initiative to develop Internet applications for global business solutions.

Paul is the co-author of *Special Edition Using Netscape*, a best-selling guide to using Netscape and the World Wide Web, first published by Macmillan Publishing in 1995. His contribution to this series is in the area of interface design for the World Wide Web. Since its release, the series has remained the most popular guide to using and designing resources for the World Wide Web. The third edition of the series, *Using Netscape Communicator*, was published in 1997. Paul has also authored articles related to the usefulness of the Internet as a medium for the distribution of educational coursework, and he continues to maintain a popular online guide for distance learning resources.