Self-efficacy, the Innovation-Decision Process, and Faculty in Higher Education: Implications for Faculty Development

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Abstract

Situated within the belief that faculty development is a key institutional mechanism through which colleges and universities will be able to meet emerging social, cultural, and technological challenges in the coming years, this study sought to better understand the underlying psychological processes that facilitate the adoption of innovations by teaching faculty and GTAs in higher education. Specifically, three types of self-efficacy (college teaching, teaching with technology, and general) were considered in light of demographic variables and Rogers' model of the innovation-decision process. Most significant among the findings were that women have significantly higher college teaching self-efficacy and general self-efficacy than men; however, men have higher teaching with technology self-efficacy. Those in their forties, fifties and sixties have higher college teaching self-efficacy than those in their twenties. Full-time instructors have higher college teaching self-efficacy than doctoral GTAs and assistant professors. Those who rate themselves as having higher computer skills also have higher teaching with technology self-efficacy. When considering teaching with technology self-efficacy and instructional technology-based innovation-decision stage, it was found that this type of self-efficacy differs significantly between most stages and consistently increases from the knowledge stage through the confirmation stage.

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The Diffusion of Innovations in Higher Education: Faculty Development as an Agent of Change

> [Change will not only be a challenge for the American university], it will be the watchword for the years ahead. And with change will come unprecedented opportunities for those universities with the vision, the wisdom, and the courage to lead in the twenty-first century (Duderstadt, 2000, jacket).

> Change, in many ways, is the engine that drives the academic enterprises of colleges and universities; and it is a cardinal responsibility of faculty to be the primary innovators and initiators of change in academe (Camblin & Steger, 2000, p. 1).

Chapter 1: Introduction and Need for Study

There is a perception that a variety of forces, both social and technological, are accelerating the rate at which change is needed and occurring in higher education (Duderstadt, 2000). Those institutions that are able to adapt, manage, and ultimately lead in this environment are likely to be the ones that will thrive on this increasingly changing landscape. There is also recognition that the primary means through which institutions change is via the creativity, innovation, pedagogy, and scholarship of its faculty (Camblin & Steger, 2000). Thus, by providing mechanisms through which faculty can continue to grow and flourish, colleges and universities can foster and influence the changes that occur within their institutions.

Faculty development programs in higher education are an institutionalized mechanism through which change may become manifest systemically. They have the potential to affect change locally, through interactions with individual faculty, and globally, as those faculty then exercise new ideas, practices, and technologies. Because of this influence, it is critical that lines of inquiry regarding how faculty development programs foster change and what role(s) that change has in the evolution of institutions be developed and explored. Further, inquiry into faculty development is a timely endeavor, as universities of the 21st century are seeking to remain relevant in a rapidly changing social and cultural landscape (Barone, 2003; Duderstadt, 2000).

Three general conclusions regarding research into faculty development can be drawn from the literature:

1. Higher education is facing unprecedented challenges due to technology and changing student populations,
2. Faculty development is believed to be a means to promote and manage the changes needed in higher education, and
3. Best practices and strategies for faculty development have been articulated; however, little has been done to validate these practices or to explore the underlying psychological processes that are affected by these practices.

It is posited that a line of research that looks beneath the surface of faculty development practices to consider the psychological processes that make them successful or unsuccessful would serve to inform those practices in pragmatic ways. By informing faculty development practices, the rate of adoption of instructional and technological

innovations that are believed to provide responses to the challenges facing higher education would be positively impacted.

The research questions that result from a review of the relevant literature are informed by viewing faculty development programs as agents of change. Similar to the faculty development literature, the change agent literature lacks significant research into the underlying psychological processes that influence the adoption of innovations; however, parallels to change agent / diffusion theory are found in the literature of health-related behavior change, and this field has begun a line of inquiry into those underlying factors (e.g., DiClemente et al., 1991; Galavotti et al., 1995; Marcus, Selby, Niaura, & Rossi, 1992; Prochaska & DiClemente, 1983). The research that follows is an extension of aspects of studies from the health-related behavior change body of literature, revised for the context of higher education, using the frameworks provided by change agent and diffusion literature (specifically, Rogers' innovation-decision process). A generalization and re-contextualization of these discipline specific studies offers data that may be used to inform the practices employed by faculty development units as well as provide direction for experimental studies seeking to understand the effects of faculty development practices, such as teaching-improvement interventions. As a result of this line of research, better methods for facilitating change in higher education may be developed with the goal of meeting higher education's challenges.

Given this broad theoretical orientation, Chapter 2 offers a review of the relevant literature and concludes with a statement of research questions, which speak to key underlying psychological factors, specifically self-efficacy, in need of exploration within the change in higher education context. Chapter 3 offers an overview of the research

methodology utilized to address those points of inquiry, including descriptions of procedures, intended populations, the survey instrument, and data analysis strategies. Chapter 4 provides a thorough description of the results of this research methodology as well as a discussion regarding the practical implications of these findings.

Chapter 2: Review of Literature

Introduction

This literature review provides an in-depth consideration of faculty development and the processes and mechanisms of change by reviewing relevant areas in the literature. Exploration into faculty development's role in institutional change begins by considering change from a non-discipline specific perspective via the broader theoretical framework offered by diffusion studies. The field of diffusion studies posits that when members of a social system adopt innovations, such as new ideas, practices, or technologies, change within that system is ultimately achieved (E. M. Rogers, 2003). The first section of this chapter examines, through the lens of diffusion studies, the process through which individuals progress toward the adoption of an innovation and the concepts associated with the adoption process, including perceived attributes of innovations, adopter categories, and rate of adoption.

While not considered an essential component of all diffusion models or campaigns, change agents are often employed to facilitate and manage the diffusion of innovations. The second section of this chapter defines the concept of *change agent* as it relates to the diffusion of innovations by examining the role of change agents in diffusion campaigns. Further, this section outlines change agent strategies, both strategies employed successfully by change agents and strategies suggested by research from beyond the field of diffusion studies. In concert with this discussion is an overview of existing change agent research as well as the identification of future areas of inquiry. Diffusion studies and change agents provide a relevant framework as the focus of this literature review turns toward the specific context of higher education.

Responding to unique challenges presented by diffusion campaigns in higher education are models and concepts developed by Havelock (1971), Hall, Wallace, and Dossett (1973), Ely (1990), Fullan (2001), and others. These theories build upon the broader conceptual landscape of diffusion studies and are explored in the third section of this chapter.

Attention in the fourth section centers upon faculty development. An exploration of the current context, range of focus, and best practices of faculty development leads to a thorough understanding of this particular mechanism for fostering change in higher education. In addition, this section provides an overview of research areas pertinent to faculty development.

While faculty development literature infrequently frames itself in the language of diffusion studies, its function and practice within higher education have clear parallels. The connection between faculty development and change agents is made in the final section of this chapter. This connection is valuable, as the foundational framework of the larger field of diffusion studies provides additional contexts for studying faculty development. As institutions seek to renew their faculty in an effort to keep pace with changes occurring in and around the American university, additional frameworks through which to view faculty development, like those offered by change agent and diffusion literature, will prove valuable.

Diffusion Studies

Diffusion studies, a field that focuses on change and the adoption of innovations, has enjoyed over a century of development. Originally growing out of traditions in anthropology, sociology, and agriculture, diffusion studies is now being applied in

numerous fields and disciplines (Evans, 1968, p. 212). Its early evolution in the late 1930's and early 1940's (Rogers and Jain, 1968) was heavily documented in the pages of *Rural Sociology* and reflects hundreds of studies formalizing the paradigms and procedures of diffusion studies (E. M. Rogers, 2003). Most notably among these is the work of Ryan (1948) and Ryan and Gross (1943). Their studies focused on the diffusion of hybrid seed corn to Iowa farmers and "influenced the methodology, theoretical framework, and interpretations of later students in the rural sociology tradition, and in other research traditions" (E. M. Rogers, 2003, p. 55). Developing from this early tradition and further formalizing many of the procedures used by Ryan and Gross and others (e.g., Coleman, Katz, & Menzel, 1957; Hassinger, 1959; Mort, 1952) is the work of Everett Rogers.

Although diffusion studies did not begin or end with Rogers, his *Diffusion of Innovations*, first published in 1962, is seen as the seminal work in the field (U.S. Department of Education, 2002). Informed by the work of scholars from many disciplines and updated to what is currently its fifth edition, *Diffusion of Innovations* (2003) has provided a widely recognized framework and theoretical basis that continues to inform the field of diffusion studies. Many fields have modified or expanded upon his theories; however, the general framework assembled by Rogers, with contributions from others, has been used as an undeniable cornerstone as diffusion studies has evolved (Fichman, 2000). Because of its broad impact and acceptance, the following discussion of diffusion studies will lean heavily upon theories developed by Rogers; however, other influential and oft-referenced sources will be used to elucidate and provide counterpoints to Rogers' views.

Four Elements of Diffusion

As defined by Rogers, "diffusion" is seen as "the process in which an innovation is communicated through certain channels over time among the members of a social system" (p. 5). The ultimate result of this process is that an individual or group will either adopt or reject a given innovation. This diffusion definition consists of four contributing elements that require further explication: the innovation, the communication channel(s), the duration of the process, and the social/systemic environment. Rogers contends, "these elements are identifiable in every diffusion research study and in every diffusion research campaign" (p. 11).

For Rogers (2003), "an innovation is an idea, practice, or object that is perceived as new by an individual or other unit of adoption" (p. 12). It is important to note that *newness* is determined by the individual considering adoption, not by how long the idea, practice, or object has actually been in existence (Van de Ven, 1986). It is also important to note that while the term *innovation* suggests change, not all changes involve innovations (R. H. Davis, 1979; Keil, 1969; Zaltman & Duncan, 1977). Change simply involves something being made or becoming different, while innovation suggests progress (Scott, 2003). Davis (1979) notes that some changes may simply involve the reversion to an old behavior, and he distinguishes change from innovation in that innovation involves the adoption of new behaviors. To illuminate this further, Dill and Friedman (1978) provide an example by noting that changes in university enrollments often result in significant organizational changes within an institution. The number of faculty positions may increase or decrease as a result, and entire departments or programs may merge or dissolve. While this certainly involves change, there is nothing necessarily

innovative or new about the approaches that have been adopted here. Conversely, Feeney (2001) studied adoption rates of a course management system at a major university. At the time of his study, the late 1990's, course management systems were certainly new and were perceived as such by potential adopters. At a minimum, the change facilitated by these systems improved course administration and provided additional instructional strategies for faculty. They provided *innovative* change, and as such, meet the full spirit of Rogers' innovation definition.

While diffusion researchers are "primarily interested in finding out how innovations diffuse among the members of a social system, why some innovations are diffused more rapidly than others, and what characteristics of innovations facilitate or impede an innovation's rate of adoption" (Damanpour, 1988, p. 546), it is sometimes difficult to clearly determine the relationship between innovations (E. M. Rogers, 2003). Where does one innovation end and another begin? The majority of diffusion research studies treat innovations as if they are completely independent entities; however, research has shown that potential adopters are likely to adopt more quickly if they recognize characteristics of an innovation as resembling those of an innovation they adopted in the past. Because of this connection, it is important to carefully define the parameters of an innovation and be cognizant of other innovations that have been previously introduced into a social system (E. M. Rogers, 2003).

The second element in Rogers' definition of diffusion is the communication channel. Rogers (2003, p. 18) defines communication "as the process by which participants create and share information with one another in order to reach a mutual understanding," and he defines communication channel as "the means by which messages

get from one individual to another." There are a number of different channels through which these messages can flow. Mass media channels, such as television, radio, web sites, and newspapers, have the ability to disperse information to a broad audience; however, interpersonal channels, face-to-face discussions between individuals, have proven to be far more effective than mass media channels in encouraging individuals to adopt an innovation (Coleman et al., 1957; E. M. Rogers, 2003; Ryan & Gross, 1943). In addition to mass media and interpersonal channels, in recent years, web-based dialogue and interactions (e-mail, chat rooms, discussion boards, blogs, etc.) have evolved as another communication channel with distinct characteristics and values that can influence adoption (E. M. Rogers, 2003).

Among interpersonal channels, research has shown that individuals are likely to adopt an innovation based upon the recommendations of those that are very similar to themselves (i.e., their peers and colleagues) (Coleman et al., 1957; E. M. Rogers, 2003; Ryan & Gross, 1943). Two terms are used to aid in understanding this phenomenon: homophily and heterophily. "Homophily is the degree to which two or more individuals who interact are similar in certain attributes, such as beliefs, education, socioeconomic status, and the like" (E. M. Rogers, 2003, p. 19). If a group of participants is homophilous, members are likely to have more rewarding, in depth interactions; however, if a group of participants is *too* homophilous, then the likelihood of new information being exchanged among members of the group is decreased. More frequently occurring than an overly homophilous group, and in many ways more problematic according to Rogers, are heterophilous groups in which the members share differences in defining attributes. While new information is abundant among members of

a heterophilous group, the trust and social bonds that make information exchanges easy and rewarding among homophilous groups are not present. Ideally, those interested in change prefer social systems where members are homophilous on most characteristics but heterophilous regarding knowledge of the innovation (E. M. Rogers, 2003).

The third entity in Rogers' definition of diffusion is the concept of time. While the inclusion of time is somewhat unique to diffusion studies among behavioral science research, it provides key touchstones through which diffusion can be measured (E. M. Rogers, 2003; Van de Ven & Rogers, 1988). For instance, adopters are categorized based on how early or late they choose to adopt an innovation, and as researchers look at adopters with finer granularity, time is used to see how quickly an adopter moves through the innovation-decision process (E. M. Rogers, 2003). Because time provides key data and structure for researchers, each of these research topics (rate of adoption, adopter categories, and the innovation-decision process) will be discussed at greater length below.

The fourth entity in Rogers' definition of diffusion is the social system. Rogers defines a social system as "a set of interrelated units that are engaged in joint problem solving to accomplish a common goal" (E. M. Rogers, 2003, p. 23). For Rogers, the members of a social system may be comprised of individuals or sets of group members; however, common goals create the parameters of the group itself within which an innovation is disseminated. Researchers have often studied group members within a social system, and network models of the diffusion of innovations have been developed to look specifically at the plurality of social exchanges that lead to adoption. The

resulting research questions focus on who is communicating with whom and how do these communications impact the spread of diffusion (Valente, 1995).

The arrangement of group members within a social system has been termed a system's social structure (E. M. Rogers, 2003). In some social systems, there is a clear hierarchy where some members have a higher rank or position and have the ability to mandate or offer strong suggestions to those in lower positions. This can clearly influence adoption rates. In this social structure, an individual may or may not have a voice or an option when it comes to the actual decision to adopt (E. M. Rogers, 1968). Rogers (1968) notes that, in authority decisions, innovations are "forced upon an individual by someone in a superordinate power position" (p. 71). As one might expect, it can be predicted that individuals will adopt an innovation as a result of an authority decision at a faster rate than if they were given an option to adopt (E. M. Rogers, 1968).

Rogers (1968) provides greater specificity when analyzing decisions in which individuals do have an option or a voice, labeling these decisions as optional, contingent, and collective. In an optional decision, individuals are completely free to adopt or reject an innovation, although it is possible for an individual to be somewhat influenced by the decisions of peers. In a contingent decision, an individual's freedom to adopt is limited in some way. Rogers (1968) offers the example that a professor cannot adopt or reject the use of an overhead projector if the university hasn't first furnished one in the classroom. Finally, in a collective decision, individuals within a social system choose to adopt based on consensus. While committees and focus groups are often employed to reach collective decisions, this type of decision can also result from informal structures within interpersonal networks through a process termed collective behavior. In this case,

individuals sense that there is a norm that must be followed. Along the same lines, Rogers found that homophilous individuals often group together in informal structures, but within these cliques, opinion leaders often emerge who can "influence other individuals' attitudes or overt behavior informally in a desired way with relative frequency" (E. M. Rogers, 2003, p. 27). Both types of collective decisions, formal and informal, have been found to positively influence adoption rates (Valente, 1995).

Although optional, contingent, and collective decisions occur more slowly, "they are more likely to result in lasting change because of the higher degree of individual participation and commitment involved in the decision" (E. M. Rogers, 1968, p. 71). As we look ahead to the topic of change in higher education, it is important to note that educational change "has been found to be considerably slower than the adoption of innovations in agriculture or medicine" because of the relatively higher level of individual participation in the innovation-decision process (E. M. Rogers, 1968, p. 71).

Innovation-Decision Process

Although the act of adopting an innovation may appear to be a single event, diffusion scholars agree that an elaborate process precedes and postdates the actual instant of decision (E. M. Rogers, 2003). One way to conceptualize and encapsulate this process is to see it as an information-seeking and information-processing activity. The goal of this activity is to minimize feelings of uncertainty regarding an innovation. Evolving from John Dewey's concept of reflective thought (Hassinger, 1959) and from Ryan and Gross' (1943) early conceptions of the innovation-decision process, this process is viewed as having five distinctive stages: knowledge stage, persuasion stage,

decision stage, implementation stage, and confirmation stage (Hassinger, 1959; E. M. Rogers, 2003; Ryan & Gross, 1943).

The knowledge stage occurs "when an individual (or other decision-making unit) is exposed to an innovation's existence and gains an understanding of how it functions" (E. M. Rogers, 2003, p. 169). Fourt and Woodlock (1960), Hassinger (1959), and other early theorists felt that individuals in this stage are "more or less passive agents" (Hassinger, 1959, p. 59). This line of thinking suggests that discovery of new innovations happens, for the most part, by forces external to the individual (marketing, salesmen, happenstance, etc.). Through this passive discovery, individuals may develop a need based on the information learned regarding an innovation (E. M. Rogers, 2003). Conversely, Rogers (2003) argues that individuals sometimes have a need that can be articulated prior to the introduction of an innovation in the knowledge stage. Because of this, those individuals may go in search of a solution and become aware of an innovation as a result of this active investigation. Whether through passive or active discovery, the establishment of a need and/or personal relevancy is paramount for ensuring that the innovation-decision process continues beyond the knowledge stage and through adoption. Without these, little motivation exists to continue with the innovation-decision process (E. M. Rogers, 2003).

The persuasion stage occurs as decision-makers / individuals "form a favorable or an unfavorable attitude towards the innovation" (E. M. Rogers, 2003, p. 174). Regardless of whether they were initially passive or active investigators or whether they recognized a need, those in this stage begin to actively seek information, weigh its value, and determine its validity. The purpose is to develop a "general perception of the innovation"

and the typical outcome is the development of an attitude toward the innovation that will enable individuals or units to make an adoption decision (E. M. Rogers, 2003, pp. 175-176).

The decision stage takes place "when an individual (or other decision-making unit) engages in activities that lead to a choice to adopt or reject the innovation" (E. M. Rogers, 2003, p. 177). Rogers sees adoption as the decision to fully incorporate an innovation, and individuals or units that choose to adopt recognize the innovation as the best course of action that currently exists. Conversely, rejection is typically the result of the innovation being found to be a poor solution to a need and can take place either actively or passively. Active rejection occurs when an innovation is considered, but upon further review, individuals or units decide not to adopt. It is important to note that during the decision stage, adopters may choose to run a trial of the innovation before making their final decision regarding adoption or rejection. This active, limited, and contingent examination of the innovation often contributes information that proves to be important as a final decision is reached (E.M. Rogers, 2003). In contrast, passive rejection takes place when the persuasion stage is simply not entered (i.e., individuals or units learn about an innovation but do not really consider it for adoption) (E. M. Rogers, 2003).

The implementation stage occurs "when an individual (or other decision-making unit) puts a new idea into use" (E. M. Rogers, 2003, p. 179). At this point in the innovation-decision process, adoption has been confirmed, but a myriad of new issues may arise. It is wisely suggested that a freshly adopted innovation be given a grace period in which unanswered questions may be explored and unforeseen problems can be resolved (Levine, 1980). This period serves to diminish the level of uncertainty that may

exist for those who are charged with incorporating the innovation within their practices. Further, especially in larger organizations where those responsible for making the decision are not the same as those responsible for implementation, this period serves to provide ample time to erode resistance against said innovation (E. M. Rogers, 2003). Even after adoption, active information gathering continues to be a significant activity. As the implementation stage progresses, some adopters may discover that the innovation does not exactly meet their needs; therefore, adopters may choose to modify or customize the innovation. As this re-invention occurs and issues become apparent, a great deal of time can sometimes pass.

Because of the evolutionary and adaptable nature of innovations, it is often difficult to discern when this stage has ended; however, Rogers (2003) offers the following guidance:

> Eventually, a point is reached at which the new idea becomes institutionalized as a regularized part of an adopter's ongoing operations. The innovation loses its distinctive quality as the separate identity of the new idea disappears. This point is considered the end of the implementation stage (p. 180).

Beyond adoption and the end of the implementation stage, it is still possible for an innovation to be rejected (Evans, 1968; Levine, 1980; Miles, 1964b; E. M. Rogers, 2003). Retention of an innovation is certainly a long-term process, and adoption is not a guarantee of continued usage (Surry & Brennan, 1998). With this recognition, Rogers describes the confirmation stage as one in which "an individual seeks reinforcement of an innovation-decision already made" (E. M. Rogers, 2003, p. 189). Typically, this reinforcement comes in the form of experiences with the innovation. Ideally, an adopter

will be pleased with the innovation's performance; however, if the innovation fails to meet the expectations of the adopters, they may choose to discontinue its usage. Rogers (2003) specifies two types of discontinuance: disenchantment and replacement. Disenchantment discontinuance occurs when an adopter is displeased with the performance of an innovation and simply chooses to reject it based upon this experience. Replacement discontinuance occurs when an adopter becomes aware of a better innovation and chooses to reject the current innovation in favor of the new one.

For Rogers, the confirmation stage has no end and always provides an opportunity for the ultimate rejection of an innovation. Even with this early recognition by Rogers of this possible eventuality, "few studies have investigated the factors that facilitate or impede long-term retention of an innovation" (Surry & Brennan, 1998, p. 9). Some theorists have come to see replacement discontinuance as a mechanism through which the entire innovation-decision process can repeat and become cyclic (Sherry, Billig, Tavalin, & Gibson, 2000). This view recognizes that "better mousetraps" are always being built, and new solutions to old needs may facilitate the replacement of an innovation.

While the innovation-decision process provides an orderly and a manageable mechanism through which a complex reality can be encapsulated, Rogers (2003) states that it is impossible, through empirical evidence, to absolutely prove that these stages do exist. Still, Rogers points out "there is a long intellectual tradition of the basic notion of stages or steps in the process of human behavior change" (p. 195), and others have conducted studies that "seem to support the validity of the stages concept" (Beal, Rogers, & Bohlen, 1957, p. 168) as it relates to diffusion studies. As a result, Rogers innovation-decision process has been widely accepted, and numerous diffusion studies over the past

forty-five years have used it as a key organizing tool (Sachs, 1993; Surry & Farquahr, 1997).

Rate of Adoption

While it has been argued that all individuals must go through the same adoption stages, it is clear that they do so at varying rates (Dormant, 1986). As noted earlier, diffusion studies has a long history that spans numerous disciplines; however, rate of adoption, as well as pattern and extent of adoption, are key concerns that unify all disciplines interested in diffusion studies. As might be expected, adoption rate is often a dependent variable in diffusion research (Fichman, 2000). Rogers defines rate of adoption in the following way:

> Rate of adoption is the relative speed with which an innovation is adopted by members of a social system. It is generally measured as the number of individuals who adopt a new idea in a specified period, such as a year. So the rate of adoption is a numerical indicator of the steepness of the adoption curve for an innovation (p. 221).

Researchers are thus interested in the variables that affect the "steepness" of this curve (see Figure 1). In addition to the variables outlined previously (such as type of innovation-decision, communication channels, and structure of social system) and the promotion efforts and approaches of change agents (to be addressed in a later section), Rogers (2003) believes that the way potential adopters perceive of innovations greatly impacts and predicts their willingness to adopt. Some theorists and researchers have described measuring potential adopters' perceptions as one of the classic issues in diffusion studies and a possible mechanism through which the results of studies

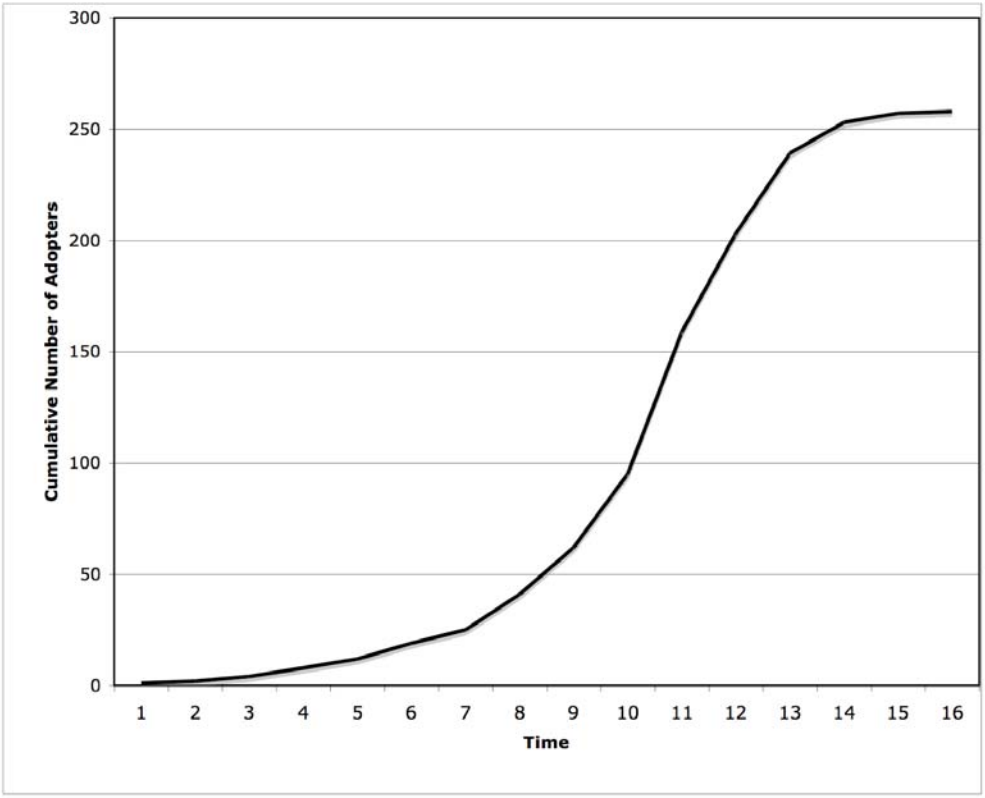

Figure 1. An Example of a Typical Adoption S-Curve

from multiple disciplines can be integrated (G. C. Moore & Benbasat, 1991; Tornatzky & Klein, 1982).

Perceived Attributes of Innovations

Rogers' (2003) Perceived Attributes of Innovations taxonomy consists of five parts and has been used, foundationally, in multiple studies (e.g., Caffarella, Caffarella, Hart, Pooler, & Salesi, 1982; Karahanna, Straub, & Chervany, 1999; Kearns, 1992; Kohl, 1969; G. C. Moore & Benbasat, 1991; Nambisan & Wang, 2000). These attributes are relative advantage, compatibility, complexity, trialability, and observability. Although a group of experts, for example, may seek to determine an innovation's actual attributes, it is the potential adopters' perceptions that are of critical importance, as it is they who will be making the choice to adopt or reject.

Some researchers have identified as many as 10 (Tornatzky & Klein, 1982), 20 (Lin & Zaltman, 1973), or even 25 perceived attributes (Kearns, 1992); however, these additional attributes can typically be seen as sub-categories within the five in Rogers' taxonomy. For instance, Tornatzky and Klein identify "cost" and "profitability" as separate attributes; however, these attributes would also fit neatly within Rogers' "relative advantage" category. Kearns (1992) identified 25 variables, including Rogers' five, by questioning participants in a study concerning the adoption of computer-based systems. Yet after analyzing these variables, it was determined that the twenty not listed by Rogers accounted for less than one percent of the variance in the resulting rate of adoption. This further validates Rogers' work; still, Rogers encourages researchers to develop unique lists of perceived attributes for each innovation that is studied (E. M. Rogers, 2003). This is prudent advice as research suggests that attribute sets do vary somewhat from innovation to innovation (Damanpour, 1988; Downs & Mohr, 1976). Developing unique lists also enables researchers to place emphasis upon specific characteristics that are found to be of unique importance to members of a particular social system. With that said, Rogers' taxonomy does provide a well-accepted rubric that is of great import to the field of diffusion studies and can serve as an excellent starting point as innovation-specific attribute lists are determined.

Rogers' Perceived Attributes of Innovations taxonomy begins with relative advantage, which is the "degree to which an innovation is perceived as being better than the idea it supersedes" (E. M. Rogers, 2003, p. 229). Potential adopters consider if an innovation provides greater benefits than all other options currently available. Relative advantage may include economic factors (actual costs, additional incentives, etc.) as well

as social factors (peer pressure, social approval, etc.), and a cost/benefit analyses is sometimes performed to vet out true advantages. Because relative advantage represents key information that leads to a decision to adopt or reject, it is not surprising that researchers have found it "to be one of the strongest predictors of an innovation's rate of adoption" (E. M. Rogers, 2003, p. 233). Also, as Rogers' definition suggests, one outcome of a consideration of relative advantage may be the rejection of an innovation that was previously adopted.

Like relative advantage, compatibility, Rogers' second attribute, has also been found to correlate positively to an innovation's rate of adoption (E. M. Rogers, 2003; Tornatzky & Klein, 1982). Compatibility is described as "the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters" (E. M. Rogers, 2003, p. 240). While a potential adopter's actual need for an innovation has clear implications for adoption, it is sometimes more difficult to determine how socio-cultural values and past experiences will influence adoption rates. Regardless of the need for an innovation, a social system's customs, history, religious beliefs, and other personal, political, and/or communal factors may prevent individuals from adopting a clearly needed innovation. Further, rate of adoption can be influenced by previous experiences with analogous innovations. If, for instance, individuals have negative past experiences with an innovation, they may then be less likely to adopt a similar, new innovation (E. M. Rogers, 2003).

Unlike relative advantage and compatibility, research has determined that an innovation's complexity is negatively related to its rate of adoption (E. M. Rogers, 2003; Tornatzky & Klein, 1982). If potential adopters feel an innovation is too difficult to

understand or apply, then it is likely that they will refuse to adopt. Although it is seen as a significant variable, research has shown that complexity may not influence adoption rates as much as relative advantage and compatibility (E. M. Rogers, 2003).

Trialability, "the degree to which an innovation may be experimented with on a limited basis" (E. M. Rogers, 2003, p. 258), also influences an innovation's adoption rate, as being able to try out an innovation may help potential adopters recognize its potential and lead to the confidence necessary to adopt. This is especially true for those that are among the first to adopt a new innovation. For late adopters, trialability appears in a different guise, typically in the form of a vicarious test through which they monitor the experiences of their peers. For this late group of adopters, hands-on trialability is often less important (E. M. Rogers, 2003).

Observability, "the degree to which the results of an innovation are visible to others" (E. M. Rogers, 2003, p. 258), in some respects, refers to the simplicity of communicability of an innovation. If an innovation or its results are easily observed and/or can easily be described, then its likelihood of adoption is increased (E. M. Rogers, 2003; Tornatzky & Klein, 1982). In some studies, individuals state they chose to adopt based upon their ability to see the results of an innovation, suggesting that observability speaks specifically to being able to witness an innovation's other attributes (relative advantage, compatibility, etc.) (Tornatzky & Klein, 1982).

While leaning heavily on Rogers' Perceived Attributes of Innovations taxonomy, Carlson (1965) makes a valuable observation that must be included in this discussion of the variables Rogers feels contributes to the rate of adoption of an innovation. Carlson questioned why some educational innovations become more widely accepted than others.

Comparing six educational innovations that were introduced in the 1950s, and using a scoring algorithm that leaned heavily on Rogers' theories, he noted that the innovations' diffusion rates did not follow predicted patterns. Further, the introduction of new innovations in school systems approximately doubled in one 15-month period. In retrospect, it is important to note that these were the 15 months that followed Russia's release of Sputnik I. Carlson made the following conclusion:

> Thus, assuming that the emphasis on change in public school systems varies from time to time, it seems that any explanation of different rates of diffusion among innovations that have existed in unlike periods of history must take this [emphasis] into account (p. 68).

Miles echoes this statement by asking "What is the role of the general *Zeitgeist* in serving as a supporter or blocker of specific changes, or as a creator of generalized openness or resistance to many changes in the system?" (Miles, 1964a, p. 41), and similarly, Reigeluth and Joseph (2002) lament how massive societal changes alter existing needs and thus impact the ability to ensure the relevancy of emerging innovations. In short, larger societal changes as well as historical events that extend beyond a given social system may make the ability to predict the likelihood (or rate) of adoption of an innovation exceptionally difficult. While Rogers' theories provide valuable guidance to create instruments to study and predict adoption (see Bass, 1969; G. C. Moore & Benbasat, 1991), Carlson's Sputnik observation provides vivid evidence that predictive models, while useful, cannot account or prepare for all eventualities.

Adopter Categories

Up to this point, characteristics of those that may potentially adopt innovations

have been only cursorily discussed; however, Rogers and others have written extensively regarding traits of adopters. Clearly, attempts to enact change in any social system / organization requires an in-depth understanding of those who are the subject of change. The literature provides extensive demographic information of adopters that is essential for those responsible for facilitating the change process.

As previously outlined, adopters, either individuals or organizations, move through the innovation-decision process over time. Rogers (2003) believes the key adopter characteristic on which to focus is "innovativeness" (how quickly an individual or organization is likely to adopt an innovation relative to others in the social system). For him, "innovativeness is the bottom-line behavior in the diffusion process," and he has found that it is often the main dependent variable within studies on diffusion (E. M. Rogers, 2003, p. 268).

Using statistical theory, Rogers (2003) discerned five adopter categories that signify varying levels of innovativeness. He recognized that the number of adoptions of any given innovation, when plotted over time, typically follows a normal, bell-shaped curve (E. M. Rogers, 2003). This is not surprising as innovativeness is a human trait, and like most human traits, such as weight and height, has a normal distribution (E. M. Rogers, 2003). Rogers used two essential statistical parameters of the normal curve, mean and standard deviation, to create the boundaries for his categories (Mahajan, Muller, & Bass, 1990). He then labeled these categories innovators, early adopters, early majority, late majority, and laggards. The first three categories are below the mean while the final two are above. Marking standard deviations from the average time of adoption creates the boundaries between these innovativeness categories. While this is not a

symmetrical representation as one might expect, Rogers (2003) recognized that there are significant differences between those that are among the very earliest to adopt an innovation and all who follow. This observation is key for later researchers (see Bass, 1969; Sachs, 1976) who modified Rogers' categories to emphasize this specific difference.

Bass (1969) and Sachs (1976) chose to reduce the number of adopter categories to two groups: innovators and imitators (or non-innovators). Bass' "innovators" category is analogous to Rogers'; however, from a functional standpoint, he sees those in all remaining categories as influenced by the decisions of those that adopted before them (Bass, 1969). While there continues to be interaction among and between innovators and other members of the social system, "innovators adopt new products independently of the influence of others in the social system while imitators are influenced by those who have already adopted" (Tanny & Derzko, 1988, p. 226). While this is clearly one reasonable approach to stratifying adopters, Rogers values the subtleties in his remaining adopter categories, as they help to explain adoption patterns over the life of a diffusion campaign.

Rogers (2003) describes innovators as venturesome. They are daring, risky, and have a high tolerance for setbacks caused by adopting new innovations. In some social systems, innovators may also be perceived as radicals (Goodwin Watson, 1964). Because of what can be interpreted as rash behavior, innovators often lack the respect of other members of their social system; however, they tend to cultivate a local peer group and develop cosmopolite social relationships. Although somewhat perceived as outsiders, innovators perform an exceptionally important role in the diffusion process, as they are the ones who introduce the innovation, in practice, to the rest of the social

system, thus acting as innovation gatekeepers (E. M. Rogers, 2003). Based on Rogers' mean and standard deviation boundary markers, innovators make up approximately 2.5 percent of the total number of adopters of a given innovation in a social system. Although some have suggested that this innovator boundary is "rather arbitrarily" defined (see Bass, 1969, p. 216), very early diffusion research in the field of education found that adoption rates begin to accelerate when about three percent of the population has adopted (Mort & Cornell, 1941). An examination of this point on a normal distribution curve accurately signals a change in the adoption activities of a given social system and further emphasizes the need to have a separate category for innovators.

Rogers (2003) describes early adopters, those that adopt after innovators, as being exceptionally well respected, judicious, and known for the care they use to successfully implement new ideas. Of the five adopter categories, the members of this group have the greatest potential to be opinion leaders as adoption rates continue to increase. They are well-integrated into the social relationships of the mainstream and have contact with innovators as well as the majority of the social system. Rogers (2003) states that once an early adopter implements a new idea, it signals a "stamp of approval" to the rest of the social system, thus igniting adoption of the innovation by the masses.

As one moves to consider the early majority, late majority, and finally laggards, the amount of opinion leadership among these individuals decreases dramatically while the time it takes for them to move through the innovation-decision process increases (E. M. Rogers, 2003). The early majority is fairly careful and deliberate; as more of them adopt, their relationships with others in the social system often serve to apply peer pressure. The cautious late majority often adopt as a response to this pressure or as a

response to increasing economic forces that influenced early adoption in the first place. Finally, laggards typically adopt when social or economic pressures become overwhelming. They are often suspicious of change, possess traditional values, and are more often than not isolated within their social system (E. M. Rogers, 2003).

After reviewing the large volume of research literature regarding innovativeness, Rogers (2003) made a number of informed generalizations regarding the socioeconomic status, personality values, and communication behaviors of adopters. Speaking broadly, Rogers states that age does not play a role in innovativeness; however, in specific disciplines such as secondary education, some researchers have found that innovators do tend to be younger than those in other categories (Carlson, 1965). In regards to socioeconomic aspects, earlier adopters are more educated, literate, socially mobile, wealthy, and possess higher social status than later adopters. There are significant personality differences as well. Earlier adopters possess greater empathy, rationality, intelligence, flexibility, and ability to deal with abstraction than later adopters. Further, earlier adopters have a more favorable attitude toward change and science and are better able to deal with uncertainty and risk than later adopters. Later adopters tend to be more fatalistic and possess more modest aspirations than earlier adopters (E. M. Rogers, 2003).

Earlier adopters and later adopters also differ in their communication behaviors. As would be expected from the aforementioned importance on communication channels, earlier adopters are more social and have more highly developed interpersonal networks than later adopters, and these networks are likely to extend beyond the parameters of the social system in question. Early adopters have more exposure to all types of communication channels and have an active interest in learning more about innovations.

Additionally, earlier adopters are also more likely to function as opinion leaders and have contact with those responsible for bringing about change (E. M. Rogers, 2003).

While these categories and generalizations are widely accepted, the majority of interest in the literature surrounds issues concerning innovators and early adopters (see Bass, 1969; Carlson, 1965; E. M. Rogers, 2003; Sachs, 1976; Tanny & Derzko, 1988). As noted earlier, this is the location on the graph where the steepness of the adoption curve (see Figure 1) will either increase sharply, thus ensuring broad adoption, or somewhat level off, resulting in limited adoption.

Summary

Rogers contends that all diffusion campaigns contain the same four, universal elements. These elements are present in his definition of diffusion: "The process in which an innovation is communicated through certain channels over time among the members of a social system" (E. M. Rogers, 2003, p. 5). Rogers describes the innovation-decision process, which leads to eventual adoption, as having five stages: knowledge, persuasion, decision, implementation, and confirmation stages.

During this process, the rate of adoption can be impacted by a number of variables, including the role adopters play in the decision process, dynamics and pressures within the social system, effectiveness of communication channels, and the strength of the need for adoption. A great deal of attention has also been given to predicting rate of adoption based upon the perceived attributes of innovations: relative advantage, compatibility, complexity, trialability, and observability (E. M. Rogers, 2003).

In addition to considering innovation traits, researchers are also interested in adopter traits, as these can provide further guidance regarding adoption patterns. Rogers

believes that innovativeness, a human trait, "is the bottom line behavior in the diffusion process" (E. M. Rogers, 2003, p. 268). Based upon varying levels of innovativeness, Rogers (2003) discerns five widely accepted adopter categories: innovators, early adopters, early majority, late majority, and laggards. Fairly accurate personality, communication, and socioeconomic generalizations can be made about individuals within each adopter category.

Change Agents

Although they are not considered an essential component of all diffusion campaigns, change agents (sometimes called change leaders or agents of change) are often employed to assist in the process of introducing an innovation to a population with the general goals of increasing its adoption rate and speeding adopters through the innovation-decision process. The phrase *change agent*, like much of diffusion studies, evolved out of agricultural and extension programs (E. M. Rogers, 2003); however, a review of change agent literature reveals that the phrase has been co-opted and extended to meet a number of purposes in a variety of disciplines and contexts. In short, the term itself is problematic. Most fields agree on the general goals and purposes of change agents, but there is great divergence on how change agents function and exist within organizations and social systems. By way of summary, it could be said that there are five definitional categories of *change agent*.

Change Agent Categories

Rogers' view of change agent could be considered the most restrictive. Rogers (2003) sees social systems as having two general classes of people: those that desire to see an innovation adopted (change agency) and those that comprise the population that

might move through the innovation-decision process toward an adoption of the innovation (clients). Here, the change agent is brought in to help facilitate the change agency's desired innovation adoption. The change agency dictates the larger adoption goals; however, the change agent must determine the client's actual needs and mediate between the two. As a result, the change agent will often act as an information conduit between the clients and change agency (Clarke, 1999; Dormant, 1986; E. M. Rogers, 2003). The change agent, then, is "a marginal figure with one foot in each of two worlds" (E. M. Rogers, 2003, p. 368).

A second view of change agent comes from fields similar to and including organization development. These fields are most centrally interested in changing the behavior of individuals within a system to improve overall organization effectiveness (Anderson & Anderson, 2001). This field's view of change agent extends Rogers' conception to include those, either internal or external to the social system, who can provide specialized assistance or support for a change campaign (Ottaway, 1979). As a best practice, rather than depending upon external consultants to facilitate change, it is specifically noted that organizations would be well-served to have an internal team whose primary responsibility is to act as an agent of change (Anderson & Anderson, 2001; Duck, 1998; Keil, 1969; Weiss, 2003). These internal consultants would be able to take full ownership over the diffusion of innovations process as well as responsibility for other types of change with a clearer understanding of the needs of their own organization. This positioning would thus provide functional advantages, such as knowing the social system's norms and having ongoing relationships with adopters, that an external change agent could not possibly possess (Dormant, 1986; Weiss, 2003). Still, this internal

conception of change agent is functionally consistent to Rogers' in that they are organizationally separated from the specific social system in which they are charged with influencing.

A third view of change agent broadly states that anyone can be a change agent. The thought here is that every person in a social system has the potential to be a change agent with the underlying belief that true change can only take place if there is personal involvement by everyone within an organization concerning the change (Chapman, 2002). Also within this conception are groups of faculty and administrators in higher education who include among their goals a desire to enact change within their institution. These groups of academic change agents are often termed *learning communities* (Cox, 2000; Cuthell, 2002).

A fourth view of change agent blurs change agent and agency. In this conception, the change agency and the change agent are one. Leaders, managers, and CEOs are often described, or describe themselves, as change agents because they provide vision and assign resources that lead to change (e.g., Beckhard, 1997; Hoff, 1999; London, 1988; Tichy & Devanna, 1990; Zakariya, 1996).

In a fifth view, the innovation itself, rather than those that work to bring about change, is described as a change agent. Scientific developments that have provided great technological leaps forward, such as Gutenberg's printing press, transistors, desktop computing, and nuclear energy, have resulted in profound social and cultural change. These technologies have been personified as change agents to underscore their human impact (e.g., Diebold, 1969; Dirckinck-Holmfeld & Lorentsen, 2003; Harvey, 1977; Laver, 1989; Tuller & Oblinger, 1998).

The phrase *change agent* has resonated across multiple disciplines and fields and into the popular culture; however, not all of these usages are consistent with the application of the term within the field of diffusion studies. The last three conceptions above are inconsistent with diffusion literature specifically because they do not separate facilitation of the change process from participation in that process. Rogers makes this distinction exceptionally clear as he summatively defines change agent: "A change agent is an individual who influences clients' innovation decisions in a direction deemed desirable by a change agency" (E. M. Rogers, 2003, p. 366). Therefore, the discussion that follows excludes conceptions of change agent that specifically frame the concept in terms that are consistent with the last three views described above.

Function of Change Agents

As described earlier, Rogers states that innovativeness is the "bottom line behavior in the diffusion process" and as a result, "innovativeness is often the main dependent variable in diffusion research" (E. M. Rogers, 2003, p. 268). As a point of summary, then, it could be stated that the main goal of change agents is to foster innovativeness in the clients within the targeted social system. It is also a fundamental assumption that clients are capable of being persuaded (Guba, 1968), and Dalton (1989) posits that, generally speaking, the single most important task of a change agent is simply to convince. To persuade, convince, and promote innovativeness, change agents fulfill a number of functions and apply numerous strategies, and their success is typically measured by examining their clients' rate of adoption (E. M. Rogers, 2003).

Rogers identifies a sequence of seven ideal functions change agents should provide to ensure the successful adoption of an innovation. First, a change agent must

broaden awareness of an innovation and show the clients that there is a need for change. Second, the change agent must develop a rapport with clients and foster a relationship that will allow for smooth and open information exchange as well as ongoing trust. Third, actual needs must be determined by the change agent and all existing solutions for these needs must be evaluated. Fourth, the change agent must develop in its clients a desire to adopt; and, fifth, this desire must be translated into action. Sixth, after adoption has occurred, the change agent must provide support and guidance for clients to ensure that discontinuance does not occur. Lastly, the change agent must end its relationship with a client, but this can only happen once the client becomes self-reliant and the change agent is certain that discontinuance is unlikely to occur (E. M. Rogers, 2003, p. 369-370). It is important to note that these functions correspond to needs that exist in clients as they progress through each of the five stages in the innovation-decision process.

Like Rogers' innovation-decision process, other theorists have provided alternative views regarding the functions of change agents. Havelock and Zlotolow (1995), for instance, outline seven stages of planned change that change agents must facilitate and manage: care, relate, examine, acquire, try, extend, and renew. Another widely-referenced view of change agent functions is offered by Zaltman and Duncan (1977). Their rubric offers six essential change agent tasks: establish a relationship with clients, diagnose, select correct helping role, determine change objectives, deal with resistance, and provide maintenance.

Havelock and Zlotolow's (1995) labels and associated descriptions emphasize humanistic elements, such as empathy and relationship building, while Zaltman and Duncan's tasks tend to focus on the project management aspects of the change agent role.

Unlike views that grow out of diffusion literature, the organization development field offers a framework emphasizing preparation as much as implementation. Still, the stages/tasks/levels/phases themselves, like Rogers' seven functions, map closely to the needs of clients/adopters as they move through the well-established notion of the innovation-decision process. Regardless of procedure, it has been noted that change agents, either explicitly or intuitively, must attend to the stages in Rogers' process (Dalton, 1989). The key difference in the aforementioned conceptions, then, is that each places emphasis on different aspects of underlying strategies that are employed by change agents as they fulfill the functions of their role.

Strategies for Change Agents

Regarding change agents' strategies, the literature offers advice that ranges from systematic to folksy; however, there are common themes that bridge both types of guidance. Rogers (2003) provides several overarching generalizations regarding change agent strategies. According to Rogers, change agents should do the following:

- Have as much contact as possible with clients;
- Ensure the innovation in question serves to meet client needs;
- Orient themselves to meet those needs;
- Be empathetic and homophilous to the target population;
- Foster credibility and work with and through opinion leaders as much as possible; and finally, change agents should
- Gather feedback from clients regarding the innovation.

This feedback should be included in the diffusion campaign's ongoing planning process (E. M. Rogers, 2003, pp. 373-391).

Other theorists offer sets of alternative / complimentary strategies. Zaltman and Duncan (1977) outline six general categories of strategies. The first five are facilitative, re-educative, persuasive, coercive, as well as the use of combinations of these strategies. They also include understanding resistance to change as a sixth strategy, in that those who resist change offer an important feedback loop that helps change agents determine the actual needs of the client population. Along those same lines, Guba (1968) says there are essentially six tools available to the change agent: telling, showing, helping, involving, training, and intervening. Further, Guba and Brickell (1974), with finer granularity, define 16 tools, including negotiation, using prestige, and leveraging additional resources.

By reviewing the aforementioned change agent strategies, universal commonalities emerge. They are communication and interaction with clients. Specific strategies in the literature provide guidance regarding how change agents can engage in successful, supportive, and persuasive communications. Rogers (2003) suggests developing a customized communication program based on the characteristics of the intended population. Zaltman and Duncan (1977) further recommend developing multiple communication plans to target subgroups within a population based upon a subgroup's current stage in the innovation-decision process and expected level of resistance. They also suggest that changing communication strategies over time to shift the focus of the message from, for example, the communication of simple awareness to persuasion, would further enhance the likelihood of increasing the rate of adoption. Rogers (2003) furthers this suggestion by emphasizing the importance of appropriately timing communication campaigns as well as actual contact with clients.

When considering agricultural innovativeness, Rogers found, in a study of approximately four thousand farmers in several nations, change agent contact was the variable most highly related to innovativeness in clients (E. M. Rogers, 2003). This was also found to be true by Purdy (1968) who researched factors that limited or facilitated the adoption of innovative practices in public schools. Foster (1968), also considering innovation in public schools, noted that outside of change resulting directly from interactions with change agents, little or no additional change or innovation was undertaken by clients. This further underscores the need for ongoing and effective interaction with clients. In summary, strategies which utilize client contact with change agents, either face-to-face or through alternative communication channels, are the most effective strategies for increasing innovativeness in clients.

Given the value placed upon interaction, it could be said that a change agent's overarching goal is not to manage change or an innovation. The change agent's role, in actuality, is to manage people (Kershaw, 1996; Moran & Brightman, 2000), and the purpose of the contact change agents have with clients as well as the associated strategies that are employed, then, is to change the behavior of those people, whether it be the adoption of a new technology or the adoption of innovative practices. Oddly, diffusion literature lacks significant research into evaluating the effectiveness of change agent strategies (N. K. Clark, 1978).

> The explanation may be methodological. Diffusion strategies have generally been examined in relationship to particular innovations whose characteristics have significant effect on the diffusion rate. Thus, strategy effectiveness has been difficult to evaluate independent of other factors (N. K. Clark, 1978, p. 22).

This provides one framework for future research regarding change agents. Further, Vance (1980) notes that diffusion literature also lacks any significant attention to underlying psychological factors, like motivation and self-efficacy, which might influence adoption. In general, research has shown that self-efficacy is a strong predictor of behavior (Maddux, Norton, & Stoltenberg, 1986), and Vance (1980) rightly recommends that change agents and others in the diffusion field would be well-served by researchers if the topic of self-efficacy was explored specifically in the context of innovation diffusion. With that said, there is research in other fields regarding self-efficacy that will provide guidance as investigations into motivation and innovation adoption are undertaken.

Change Agents and Client Self-efficacy

Self-efficacy is defined as a belief held by an individual that "one can successfully execute the behavior required to produce the [desired] outcomes" (Bandura, 1977, p, 79). It is a personal judgment about one's "capabilities to organize and execute courses of action required to attain designated types of performances" (Bandura, 1986, p. 391). Bandura (1997), when considering the cognitive activities that impact motivation, states that "the self-efficacy mechanism of personal agency operates in all of the variant forms of cognitive motivation" (p. 123). In short, self-efficacy plays "a central role in the cognitive regulation of motivation" (p.122). While self-efficacy is rarely referenced directly in diffusion literature, its presence pervades it.

Zaltman and Duncan (1977) state that adopters' insecurity about their ability to perform can act as a barrier to adoption. If clients don't have confidence that they can use an innovation successfully, they are less likely to begin using it (Poole, 1991). Moran

and Brightman (2000), Bates (2000), McAlpine and Weston (2002), and Hodges (2006) suggest that outright fear of failure with an innovation prevents adoption. Regarding self-efficacy and change agent strategies, Morin (1975) feels that change agents should inspire clients to adopt; Clarke (1999) and Rogers (2003) vaguely state that change agents should foster an intent to adopt; and Dalton (1989) offers that change agents should convince clients to adopt. Certainly, part of the shift that takes place within adopters as they decide, are inspired, or develop an intent to adopt is a personal belief that they will be successful with an innovation once they embrace it. Therefore, the role of self-efficacy in innovation adoption is apparent and certainly constitutes a reasonable line of future inquiry for diffusion scholars.

Bandura (1997) defines four principle sources of self-efficacy. They are enactive mastery experiences, vicarious experiences, verbal persuasion (and other types of social influences), and an individual's affective states. Many of the aforementioned change agent strategies can be easily grouped into three of Bandura's four sources of self-efficacy. For instance, Guba (1968) offers telling, showing, helping, involving, training, and intervening as key change agent strategies. Mastery experiences can be provided by helping, involving, training, and intervening. Vicarious experiences can be provided by showing and training, and verbal persuasion can be provided by telling as well as through communication during all other strategies. Again, while the connection to the theoretical concept of self-efficacy is apparent, diffusion literature lacks specific references to self-efficacy's role in the adoption process or to the idea that change agents should specifically aim to improve client self-efficacy. This may be due to the fact that a great deal of diffusion literature seeks to provide pragmatic and easy-to-follow advice for those

on the front lines of diffusion campaigns. Other fields, however, possessing similar characteristics to those of innovation diffusion, such as counseling and health-related behavior change, have explored the concept of self-efficacy within their conceptual frameworks.

Related Self-efficacy Research

One way to conceive of Rogers' five-stage, innovation-decision process is that it is simply a way to articulate the process through which a behavioral change is enacted. In truth, stages views of behavioral change have been used in a variety of fields for a variety of problems (DiClemente et al., 1991). Although the language is slightly different, researchers interested in overt behavior change, such as the cessation of smoking and other addictive behaviors (DiClemente et al., 1991), the adoption of exercise regiments (Marcus et al., 1992), and the use of contraceptives (Galavotti et al., 1995), articulate behavioral change in ways that mirror the innovation-decision process; they have labeled this process "the stages of change." In the stages of change, like the innovation-decision process, there are five stages. While the descriptions of the stages parallel those in the innovation-decision process, their labels differ and are as follows: pre-contemplation, contemplation, preparation, action, and maintenance (DiClemente et al., 1991; Galavotti et al., 1995; Marcus et al., 1992; Prochaska & DiClemente, 1983). Because of these similarities, the following research into overt behavior change has meaningful implications for those interested in facilitating the adoption of innovations.

Galavotti et al. (1995) developed a study to assess the applicability of the transtheoretical model of behavior change to the adoption and use of contraception in women. Like the innovation-decision process, the transtheoretical model consists of five

stages and incorporates key concepts regarding human behavior to explain how and why behaviors change (Galavotti et al., 1995).

Galavotti et al. (1995) recognized that self-efficacy and decisional balance were two key variables that showed consistency across other transtheoretical studies. Their approach was to apply Nunnally's principles for the measurement of constructs to look at key variables to determine if the patterns within those variables matched those of previous studies regarding the transtheoretical model of behavior change. Data was collected from the CDC's Prevention of HIV in Women and Infants Demonstration Project. Women from five cities (San Francisco, Portland, Oakland, Pittsburgh, and Philadelphia) possessing specific sexual activity characteristics were included in the study. A final, usable sample size of 296 was determined.

A questionnaire designed by a team of four researchers was developed and only items on which all researchers could agree were included in the instrument. The questionnaire collected quantitative and qualitative data in four areas: demographic and background information, current stage of change, decisional balance, and self-efficacy. Questions regarding current stage of change centered upon contraceptive use, practices, and methods, and data regarding decisional balance and self-efficacy were collected via in-depth interviews conducted face-to-face with the study participants.

While the core result of this study was the finding that the transtheoretical model of behavior change was statistically accurate for understanding the contraceptive use patterns of women at high risk for HIV, the additional findings regarding self-efficacy have more direct applicability for diffusion researchers. Using an ANOVA to compare self-efficacy scores between the five stages, Galavotti et al. (1995) found that self-

efficacy scores significantly increased after the pre-contemplative stage and increased progressively higher at each additional stage. Further, even at the .001 level, all self-efficacy results between stages were found to be significant. These findings regarding self-efficacy and a stages view of behavior change have been duplicated in other studies as well (e.g., DiClemente et al., 1991).

Along these same lines, Marcus et al. (1992) considered stages of change and self-efficacy through the lens of the adoption of a physical exercise regiment. Citing the literature, Marcus et al. summarizes that stages of change models and self-efficacy have aided in the accurate prediction of health-related behavior change. Their study had three goals: develop a scale to measure stages of change for exercise behavior; determine where most people are along this scale; and determine if a self-efficacy measure would predict in which stage a participant currently stands.

Participants were sampled from a government agency in Rhode Island. The population consisted of approximately 5,000 state employees and 1,063 opted to participate. The demographic profile of the sample closely matched that of the larger population. Participants in this study were asked to complete a questionnaire that asked questions regarding their demographic information, exercise patterns, smoking status, and other health-related behaviors. A “stages of change” measure was included in the survey that enabled the researchers to place each participant in one of the five stages. A five-question self-efficacy measure, designed to determine each participants’ confidence in performing exercise, was administered. In the resulting analysis, self-efficacy was the dependent measure and the self-efficacy instrument was found to have an internal consistency of .82.

A one-way ANOVA was used to assess the relationship between self-efficacy and stages of change. Further, chi-square analysis and ANOVAs were used to determine relationships between the demographic variables, stages of change, and self-efficacy scores. Like Galavotti et al. (1995), Marcus et al. (1992) found that self-efficacy scores significantly increased after the first stage (precontemplative) stage and increased progressively higher at each additional stage. These findings were significant even at the .001-level. Further, the proportion of variance explained by the stage of change was quite high (.23). Interestingly, none of the demographic characteristics significantly impacted stage of change or self-efficacy. Marcus et al. offer the following conclusion:

> Individuals at various stages have different degrees of exercise-specific self-efficacy. This suggests that individuals at the different stages might benefit from interventions that differ in their focus on enhancing efficacy expectations (1992, p. 64).

Their recommendation for an intervention is analogous to a recommendation to employ a change agent.

While it is important that verification of these findings take place within an innovation adoption context, it is likely that this line of inquiry has revealed part of the dynamics of one of the key psychological factors at play during innovation adoption. General advice has been provided for researchers who wish to begin a line of inquiry into self-efficacy. In short, "self-efficacy must be specifically rather than globally assessed, must correspond directly to the criterial performance task, and must be measured as closely as possible to the time of task" (Pajares & Miller, 1994, p. 194). In self-efficacy research, Pajares and Miller note that these three items are rarely followed and have often

resulted in "poorly defined constructs, confounded relationships, ambiguous findings, and uninterpretable results."

Summary

In summary, a change agent is an individual, either internal or external to a social system, "who influences clients' innovation decisions in a direction deemed desirable by a change agency" (E. M. Rogers, 2003, p. 366). The term change agent has been used and reused as part of popular nomenclature; however, applications of the term that identify change agencies, clients, or innovations as change agents are inconsistent with a diffusion of innovations view of the concept.

The overarching function of change agents is to foster innovativeness in clients and their success is usually measured by examining their clients' rate of adoption (E. M. Rogers, 2003). Rogers (2003), Havelock and Zlotolow (1995), Zaltman and Duncan (1977), Anderson and Anderson (2001), Moran and Brightman (2000), and Duck (1998) provide oft-referenced lists of functions that change agents should perform during diffusion campaigns.

The core strategies provided in the literature emphasize supportive and persuasive interaction and communication with clients. It is also recommended that change agents tailor their communication and interaction strategies to target specific needs of clients at different stages in the innovation-decision process. Outside of these informed recommendations, little evaluation of specific change agent strategies has taken place (N. K. Clark, 1978). This provides one area of future research.

Another area of future research involves the underlying psychological factors that influence innovation adoption (Vance, 1980). While much is known concerning general

characteristics of adopters (innovators, late adopters, etc.), little has been done to explore how self-efficacy and motivation influence adoption. Diffusion literature speaks indirectly to self-efficacy by offering change agent strategies that attempt to decrease clients' fear of an innovation, mitigate clients' insecurity about their ability to use an innovation, and bolster client confidence regarding future success with the innovation (Bates, 2000; Clarke, 1999; Dalton, 1989; Moran & Brightman, 2000; Morin, 1975; E. M. Rogers, 2003; Zaltman & Duncan, 1977). Bandura (1997) provides a framework for considering self-efficacy including a rubric outlining four principle sources of self-efficacy. A vast majority of the change agent strategies provided in the literature can be mapped to three out of four of these principles.

Although diffusion literature lacks significant inquiry into self-efficacy, research into overt behavior change, such as smoking cessation, the adoption of exercise regiments, etc., has made introductory progress. The parallels between the articulations of change models within these contexts mirrors Rogers' innovation-decision process. This suggests that similar research models within diffusion studies could be informative and may result in the recommendation that change agents employ strategies that have the greatest, most positive impact upon adopter self-efficacy; however, as this and related self-efficacy research is undertaken, it is important to note that "self-efficacy must be specifically rather than globally assessed, must correspond directly to the criterial performance task, and must be measured as closely as possible to the time of task" (Pajares & Miller, 1994, p. 194).

Diffusion of Innovations in Higher Education

To this point, a general overview of diffusion theory has been offered, and while it has clear implications for anyone interested in the adoption of innovations, it is logical to consider the subset of diffusion literature specifically interested in higher education as our attention begins to turn towards faculty development. Faculty development, in its most fundamental sense, is one of several possible institutional responses to change, or a means to foster change, in an academic environment (Chait & Gueths, 1981). Therefore, an appreciation of how classical models and theories of diffusion are modified, specifically in higher education, serves to provide a context for understanding the role and value of faculty development. There are other compelling reasons that further emphasize the need for this narrowing focus in preparation for a discussion of faculty development.

As outlined earlier, much of the foundational research in diffusion studies is based on considerations of agricultural innovations; however, it has been noted that the nature of those innovations "limits the usefulness of generalizing this knowledge to educational innovation adoption" (Hall et al., 1973, p. 2). Zaltman, Florio, and Sikorski state that "change in education is more difficult than in many other sectors of society" (1977, p. xv), and recent research has shown this to be true. Innovations in education have a far greater failure rate than those in the public sector or in business (70 percent in education, 47 percent in the public sector, and 30 percent in business) (Bolman & Deal, 1999; Borins, 2001). In truth, "few groups have as many innovations, or pseudo-innovations presented to them with as little hard evidence about their effectiveness as do educators" (Zaltman et al., 1977, p. 30). Collectively, these concerns suggest that innovation

campaigns within the context of higher education present complex, if not unique, challenges.

A number of contributions from the field of education have already been chronicled (e.g., Carlson, 1965; Havelock & Zlotolow, 1995; Mort & Cornell, 1941; Zaltman & Duncan, 1977), as they have had influence far beyond their discipline; however, the discussion in this section will focus on models that have specific applications in higher education and have arisen in response to the aforementioned likelihood of unique challenges. In addition, faculty development will be positioned as an institutional means to facilitate innovation adoption.

Havelock's Review and the Linkage Model

A discussion of modern theories of innovation diffusion in education begins with Havelock (1971), whose model resulted from an exhaustive review of pre-1970s diffusion literature. The United States Department of Health, Education, and Welfare's Office of Education funded Havelock's review, and while his research considered the full range of diffusion literature, educational literature was central to his focus. As a result, his findings are seen as having clear value for diffusion campaigns in educational settings, and like Rogers, Havelock's review and synthesis is frequently cited in the educational diffusion literature.

Havelock summarized the models, theories, and ideas found in the literature by distilling common themes into three summative models: the Problem-Solver Model; the Research, Development, and Diffusion Model; and the Social Interaction Model (Havelock, 1971). The Problem Solver Model's key player is the external change agent. Here, change agents manage the diffusion process through extensive interaction with

clients. Based upon articulated client needs, the change agent then works to reduce these needs by developing solutions in collaborative ways. The psychological concept of need reduction underpins this model's iterative process, which, in this change agent/client context, results in a five-stage model through which both pass through collectively. These stages are discovery, need articulation, solution possibilities determined, solution selection, and solution application. At the end of the fifth stage, the desired outcome is a reduction in need; however, client analysis should again be undertaken to determine if the need reduction cycle should be revisited (Havelock, 1971).

Unlike the Problem Solver Model, the Research, Development, and Diffusion Model does not consider the clients' needs as primary motivators in the process; however, there is an assumption that needs are implicit to the process. In this model, the focus is not centrally upon the diffusion process as much as the process that initially spawns and develops the innovation prior to diffusion. As the name suggests, emphasis is on the research and development process, leading to the invention of the innovation, as much as the diffusion process that follows. These three elements comprise the stages of the model and suggest that there is an "orderly transition of knowledge from the *research* to *development* to *diffusion* and finally to *adoption* by the consumer" (Havelock, 1971, p. 2-42). Havelock offers the example of university research that is then diffused through extension offices as an exemplar of this model in practice.

Finally, Havelock offers the Social Interaction Model. The underlying principle supporting this model is the constructivist belief that knowledge is created through the interaction of individuals in a social system (K. T. Henson, 2003). While change agents may play a role within campaigns utilizing this conception of diffusion, the focus is on

the interactions clients have with opinion leaders, peers, the change agency, and others. Those embracing this diffusion model see the social system and the larger "society as a network of roles and channels of communication with organizational and formal and informal associations forming barriers and overlapping connections" (Havelock, 1971, p. 2-43). One hallmark of this model is that diffusion is framed as an evolving process, underscored by a variety of interactions, rather than a static adoption event.

While Havelock's literature review resulted in these three models, he emphasizes that they are not necessarily in conflict with one another. As a result, he offers a fourth model, termed the *Linkage Model*, that synthesizes what he perceives as the best aspects of each, including the need reduction cycle; the value of communication and interaction; and the need for research and development to inform and provide solutions, practices, and innovations. Communication channels between clients and those engaged in research and development are seen as key, not only to inform the innovation development process, but also as a means to enhance the need reduction cycle and the client's own problem solving abilities (Havelock, 1971).

Concerns-Based Adoption Model

Bearing similarities to Havelock's Linkage Model, while maintaining a devotion to his Problem Solving Model, is the Concerns-Based Adoption Model (CBAM) (Hall et al., 1973). Foundational assumptions of this model, such as "change is a process rather than an event" (Hall, 1979, p. 202), follow from the classical theories posited by Rogers; however, Hall et al. were also intrigued by the work of Fuller (1969), who considered the concept of concerns in the context of teacher education. In some respects, CBAM may be viewed as a sub-process within Havelock's larger Linkage Model, as it assumes that

an innovation has been chosen; the social system is prepared for adoption; a plan supporting adoption has been developed; and change agents are in place to support the process (Ellsworth, 2000). Still, within diffusion literature, CBAM "represents a unique way of looking at the change process" (Hall & Hord, 1987, p. 17) specifically because of the focus on the concerns of adopters.

Hall defines the term "concerns" as a conglomerate of "various motivations, perceptions, attitudes, feelings and mental gyrations experienced by a person in relation to an innovation" (Hall, 1979, p. 203) and asserts that "concerns expressed by individuals adopting an educational innovation within institutions progress from a focus on self, to task, to impact" (Hall et al., 1973, p. 14). This is where Fuller's work clearly informs CBAM. Hall et al. also offer a *stages of concern* rubric which provides greater granularity regarding these three types of general innovation concerns. These stages are similar to the "stages of change" rubric posited by Hassinger (1959), Rogers (2003), and Ryan and Gross (1943) in that they chart an adopter's progress toward adoption; however, the Hall et al. conception of stages specifically focuses on adopter concerns as the unit of measure. These stages are awareness, informational, personal, management, consequence, collaboration, and refocusing. It is important to note that all three types of concerns (self-oriented, task-oriented, and impact-oriented) are present at each of these stages; however, the defining characteristic of each stage is the prevalence of one type of concern over the others.

As in Havelock's Problem Solver Model, change agents are an essential component of CBAM, as they are charged with collecting and responding to concerns data, tracking levels of use, and developing new innovation configurations in

collaboration with adopters. Hall et al. note that, "as a partial expression of an adopter's needs, [concerns] provide both a diagnosis and a prescription for action" (Hall et al., 1973, p. 6). It is then recommended that change agents, as an integral part of this process, use these diagnostic tools to develop a diagnosis profile (Hall & Hord, 1987). With such documentation, the change agent may then develop appropriate interventions.

After reviewing CBAM scholarship, Hall and Hord (2001) recently identified eight types of change agent interventions that have been used in educational settings. They include information diffusion, creating a context for change, ensuring a shared vision of the innovation/change, planning and providing resources, checking on progress, training, providing continuous assistance, and communicating the progress of the adoption process to others. In light of the discussion of change agents above, these eight items could be described as the functions of change agents in educational settings with goals that include increasing adopter self-efficacy and motivation, and ultimately assisting an adopter's own mechanisms for resolving self-concerns. The definitive goal being that adopters will move more quickly through the stages of concern and their adoption rate of the innovation in question will increase.

Ely's Conditions for Change

Although not offered as a complete model, Ely's contribution to educational diffusion theory comes in the form of an examination of the environmental conditions that impact adoption (Ely, 1990). Ely was the first to emphasize that characteristics of the larger context of adoption, not just the properties of the innovation itself, can significantly influence adoption (Ellsworth, 2000). His research interest is clearly focused upon the implementation stage, and he is one of the few who has conducted

research into this stage within the arena of educational innovations (Surry & Ensminger, 2003).

Ely's most significant contribution is the identification and validation of eight conditions that facilitate change efforts. He has also shown that these eight conditions are valid in a variety of cultural contexts, including the third world, and while he is careful not to suggest these conditions provide a formula for success, he does offer that their applicability is far reaching (Ely, 1989). Research has further vetted these conditions as it has been shown that they hold true for technological as well as non-technological innovations (Ensminger & Surry, 2002, April).

Ely's conditions are as follows (Ely, 1990):

1. Members of the social system should be dissatisfied with the status quo;
2. Adopters should possess enough knowledge and skills to use the innovation;
3. Required resources should be available. This may include money, equipment, and/or personnel;
4. Adopters should be provided with time and be duly compensated for experimentation with and implementation of the innovation;
5. Rewards and incentives should be offered to adopters;
6. Participation in the adoption process should be encouraged and expected of all key stakeholders;
7. It should be made clear to adopters the institutional leadership is committed to the success of the innovation; and

8. It should be easy for adopters to identify members of the leadership community (both high-level and project management), and communication with these individual should be easy to access.

As a practical way to apply these conditions, Ely (1990) suggests turning each condition into a question. For example, "Are faculty dissatisfied with current methods for assessing critical thinking skills?" This rubric, then, provides another diagnostic tool for change agents, as the answers to the resulting eight questions will serve as a needs assessment, providing guidance to control variables that might diminish the likelihood of adoption. While this is true, Ellsworth (2000) notes that it is unlikely that change agents will have enough influence or power to alter all of the conditions in the desired direction.

Over the past few years, researchers have attempted to identify which of Ely's conditions exert the greatest influence. Ensminger and Surry (2002, April) surveyed faculty on an instructional technology listserv to determine which of the conditions were perceived as the most influential by faculty in higher education. The context provided to those surveyed was the implementation of an online degree program, and Ely's eight conditions were converted into case-based scenarios as part of the survey. The results show that faculty value all eight when implementing online programs, thus validating Ely's rubric; however, there were statistically significant differences in how important each item was perceived. For instance, adequate resources was found to be most important in this context; required knowledge and dissatisfaction with the status quo also were found to be more important than the other conditions.

Ely's conditions have been explored further. When considering a business setting and an educational setting, all eight conditions were again found to be of value in both

environments; however, data comparison showed that the relative importance of the conditions were valued differently in the higher education versus business contexts (Surry & Ensminger, 2003). Because of this finding, the authors suggest that research into setting characteristics be explored to further explain these differences. It is also suggested that an examination of Ely's conditions in conjunction with other models may provide another important area for researchers to explore (Ellsworth, 2000).

Additional Perspectives

In addition to the models and theories posited by Havelock, Hall, and Ely, there are a number of places in the literature that further enlighten the process of diffusion in higher education. Most of the following suggestions / theories evolved from secondary education, marketing, and the field of systemic change, but all have been compellingly integrated into the higher education context. A discussion of these additional significant perspectives follows.

Innovation Characteristics in Higher Education. As outlined previously, Rogers offers five innovation characteristics that contribute to the rate of adoption. They are relative advantage, compatibility, complexity, trialability, and observability (E. M. Rogers, 2003); however, Holloway (1978) found that adopters do perceive of a sixth characteristic, "status/prestige," when specifically considering an educational innovation. Two more innovation characteristics were stratified out in a recent report concerning successful distance education programs. As faculty consider the adoption of web-based instruction, they are also cognizant of institutional support as well as faculty support (Institute for Higher Education Policy, 2000). While these three additional characteristics could possibly fit into Rogers' characteristics of relative advantage and compatibility,

Rogers does recommend developing lists that are specific for a given social system (2003), and because of unique adopter needs in higher education, it may be prudent to stratify innovation characteristics into these eight areas in future rate of adoption studies.

Factors Influencing Progress Toward Adoption. Additional important perspectives are provided by Fullan (2001) in *The New Meaning of Educational Change*. Although focusing on secondary education, Fullan's three editions are referenced throughout educational change literature and clearly have value for higher education. It has been noted that there are numerous correspondences between this work and the work of Rogers (2003) and Ely (1990); however, there are significant re-framings of Rogers' work that should be noted (Ellsworth, 2000).

Rather than looking at the innovation-decision process as a series of stages, Fullan (2001) calls the process *initiation* and focuses on the factors that influence adopters' progress toward implementation. Eight factors are identified and can be phrased as questions (Fullan, 2001):

1. Are there quality innovations available for consideration during initiation?
2. Do decision makers and adopters have easy access to innovations as well as information about the innovation?
3. Is there an advocate for the innovation?
4. Are avenues in place to facilitate dialogue between instructors?
5. Are change agents external to the social system in place to facilitate the adoption of the innovation?
6. Is there strong support or pressure for the innovation within the social system?

7. Are policies and funds in place to support innovation adoption and implementation?
8. Is the larger organization driven by a desire to solve problems or by an opportunistic desire to gather resources?

For all but the last question, affirmative answers are desired. Initially, there appears to be conceptual overlap with Ely (1990); however, Fullan's focus is on initiation, which precedes implementation, while Ely is considering implementation itself. This suggests that some conditions, such as change agents, funding, communication, and information exchange, are necessary throughout the innovations-decision process as conceived in higher education.

Systemic Change. Another oft-cited resource in the literature is Reigeluth and Garfinkle's *Systemic Change in Education* (1994). Ellsworth (2000) states that this book is the essential first step for change agents in the process of developing an understanding of the systems thinking paradigm and further suggests that change efforts should be informed by this broader orientation. In short, systemic change "offers a metaphor for understanding the complex, nested interdependencies among system components that allow the system to function as more than the sum of its parts, or leave it unable to function" (Ellsworth, 2000, p. 212). Ellsworth summarizes *Systemic Change in Education* by providing four key ideas for change agents:

- Ensure all stakeholders are involved in the adoption process;
- Work towards the ideal solution by challenging barriers;
- Recognize that due to interrelationships, plans may result in unexpected ripple effects; and

- Implement organizational changes to ensure the success of the innovation.

While the last item suggests larger systemic change rather than innovation adoption, this macro-level guidance compliments the pragmatic strategies offered by Rogers (2003), Havelock and Zlotolow (1995), Hall et al. (1973), and Zaltman and Duncan (1977). It is worth noting that within the context of secondary education, a process model, called the Guidance System for Transforming Education (GSTE), has recently been developed which is intended to assist in the facilitation of systemic change (Joseph & Reigeluth, 2005).

The Market Model and Research Designs. There is another line of thought within higher education that frames change and innovation adoption in terms associated with marketing and business. Holloway's influential chapter in the first edition of AECT's *Handbook of Research for Educational Communications and Technology* reviews research designs associated with the diffusion and adoption of educational technologies. He frames his review with the assumption that "the diffusion process is similar to a market model based on a knowledge cycle" (Holloway, 1996, p. 1107). While this view is found elsewhere in higher education diffusion literature (e.g., Duderstadt, 1996; Foa, 1993; Nambisan & Wang, 2000), it is rarely articulated in these terms or put forth as the preeminent view. Holloway argues that this is due to a combination of factors associated with most educators' belief systems. For example, he suggests that educators are simply unaware of market concepts; they feel learning should be the primary focus; and they believe financial profit is an inappropriate metaphor for an educational context. However, recognizing these beliefs, Holloway concludes that, "studies of diffusion and implementation in all disciplines strongly resemble market research" (1996, p. 1109).

The key difference Holloway cites regarding the market model within educational settings is that adoption in education is not driven by fiscal rewards, unlike most other social systems. Rewards in education are often associated with status, reputation, feeling modern, as well as the reward of solving administrative or educational problems. For Holloway, "it is a belief system, not an economic or empirical warrant, that determines the acceptance and success" of innovations (1996, p. 1110).

Faculty Development, Change, and Higher Education

As one considers the aforementioned models and theories, there is often the presumption that a change agent is present to manage or facilitate the process of change. The Linkage Model and CBAM are dependent upon change agents to assist and intervene. Ely's conditions for change, Fullan's factors that influence progress toward adoption, and Rogers' innovation characteristics provide diagnostic tools to empower and inform change agents. Often, institutions of higher learning utilize faculty development programs and processes as a means to manage and facilitate the change process (Chait & Gueths, 1981). Faculty development as an institutional response to change management and facilitation will be the focus of the coming section.

Summary

While the body of literature regarding the diffusion of innovations and change agents has value for those considering change campaigns in higher education, models of diffusion and strategies for change agents have been customized and developed in response to beliefs and characteristics specific to those in colleges and universities. Havelock's (1971) Linkage Model, which is situated in the field of education and created connections between the three major themes in the literature at that time, is the result of a

synthesis of pre-existing models. CBAM, focusing on the concerns of adopters as managed by change agents, was also originally placed in and intended for an educational context (Hall et al., 1973).

Other concepts have been offered for higher education that either build upon existing models, often Rogers, or provide complimentary insights. Among the most important are Ely's eight conditions for change that focuses upon the educational environment in which the adoption is intended to occur (Ely, 1990). While Ely's conditions are posited within Rogers' implementation stage of the innovation-decision process, Fullan (2001) offers eight factors that influence this process prior to the implementation stage. In some cases, there is overlap between the two. The higher education diffusion literature also offers three additions to Rogers' five perceived attributes of innovations; they are status/prestige, faculty support, and institutional support for the innovation.

Reigeluth and Joseph (1994) and Holloway (1996) offer influential views that are less dependent on Rogers. Reigeluth and Joseph emphasize a systems view of adoption that recognizes adoption may be hindered by forces outside of a given social system or may have unintended consequences for those who are perceived to be beyond the social system. In a systems view, a consideration and examination of interdependencies is key. Holloway couches innovation adoption in marketing terms driven by rewards; however, he emphasizes that rewards in education are not typically monetary.

Within this higher education context, faculty development is frequently responsible for recognizing the interdependencies, mitigating the resistance factors, and facilitating the innovation-decision process. In the following section, faculty

development will be defined, best practices will be discussed, and a summary of faculty development research areas will be offered.

Faculty Development in Higher Education

There is a complex set of issues that foster a need for faculty development in higher education. In this environment, change is seen as "the engine that drives the academic enterprises of colleges and universities, and it is the cardinal responsibility of faculty to be the primary innovators and initiators of change in academe" (Camblin & Steger, 2000, p. 1). However, a detailed study of institutional goals by Gross and Grambsch (1974) found that faculty are "concerned primarily with preventing change and preserving the status quo" (Simerly, 1977, p. 47). While the dichotomy presented here somewhat exaggerates the difficulties of innovation adoption within higher education, it does broadly underscore the larger rationale behind the belief that faculty development is a required component on most institutional landscapes (Rouseff-Baker, 2002; Wright, 1999).

Further complicating this environment is the truism that top-down decisions regarding change in higher education are often ineffective and sometimes garner strong, negative responses from faculty who feel left out of the decision-making process (Dirckinck-Holmfeld & Lorentsen, 2003; Kershaw, 1996; Taylor, 2003). The locus of control for effective and long lasting institutional change rests with individual faculty members; however, administrators feel that one of their most serious challenges is how to simply ensure that faculty are professionally active at every stage of their careers (J. A. Fuller & Evans, 1985). Encouraging innovation and fostering an environment supportive of change is an even more complex objective than helping to ensure career-long vitality.

Recognizing these challenges, faculty development programs have been funded and charged with the leadership and implementation of interventions to support institutions as they strive to achieve the goal of faculty renewal.

For some, the expression "faculty development" offers negative connotations, as most faculty do not see themselves in need of developing (Gerth, 1973; Schecter, Conway, Neylon, & Pemberton, 1998). However, human development is a life long process through which each of us continues to grow psychologically through late adulthood (Feldman, 1997; Hodgkinson, 1974; Reich, 1994). The phrase "faculty development" implies career-long faculty evolution and accurately reflects the goals of such programs.

While the literature regarding faculty development is quite vast, there is general cohesion regarding its overall purpose. In its broadest sense, faculty development can be seen as "an institutional process which seeks to modify the attitudes, skills, and behavior of faculty members toward greater competence and effectiveness in meeting student needs, their own needs, and the needs of an institution" (Francis, 1975, p. 720). While not all faculty development programs strive toward the full range of goals implied in this definition, it is accurate that the phrase loosely refers to a "myriad of activities that colleges undertake to enhance individual or institutional capacities" (Alfano, 1993, p. 68).

Current Context

The 1990s brought with it a growing set of challenges for faculty development, including "reform in education, the technology revolution, the Information Age, [and] the changing paradigm" (Gillespie, 1998a, p. 1). The education reform movement continued

to scrutinize the quality of instruction in higher education and placed enormous pressure on universities to change (Green, 1995). There was also a sense that the student population was changing and that outdated teaching methodologies might "no longer reach students who may be underprepared, ethnically diverse, part-time, or any combination" (Millis, 1994, p. 456). In short, a renewed emphasis on the quality of teaching and learning in higher education was one of the results of the reform movement (Cranton, 1994; Fulton, Licklider, & Schnelker, 1997; Gaff & Simpson, 1994; Simpson & Frost, 1993).

Cognitive research on learning also influenced higher education as the concept of socially-constructed knowledge, the value of interaction, and associated teaching strategies grew in popularity (Fulton et al., 1997; McKeachie, 1990; Wilkerson & Irby, 1998). These theories and practices signaled the beginning of a paradigm shift away from a simple focus on improving teaching to an effort to provide greater understanding regarding how students learn (Barr & Tagg, 1995; Wilkerson & Irby, 1998). Barr and Tagg (1995) detail the Instruction Paradigm to Learning Paradigm shift and acknowledge that this change will likely take decades. Still, the pressure to reform and the complimentary need to diffuse new learner-centered instructional and assessment strategies were partially responsible for the surge in faculty development activities in the nineties.

While the cognitive revolution was influencing the content and theoretical underpinnings of faculty development, the birth of the World Wide Web (WWW) in 1991 presented new challenges and opportunities as well. There was a belief that the WWW and other emerging technologies had the ability to "generate qualitative changes

in the learning process" (Tubin & Chen, 2002, p. 517) and "improve the quality of teaching by achieving higher levels of learning, such as analysis, synthesis, problem solving, and decision-making" (Bates, 2000, p. 1). The capabilities of the WWW were also seen as a mechanism to implement instructional strategies suggested by cognitive research (Fulton et al., 1997). By 1995, instructional applications of the WWW and other information technologies had began to be adopted by the early majority at many institutions (Gilbert, 1996), and as a result, the need for computer, internet, and application skills developed into another opportunity for faculty development programs.

The rise of online, distance learning programs also contributed to this perceived technological training need. Universities saw the WWW as a new vehicle for the delivery of courses and degree programs to diverse and adult populations (Olcott & Wright, 1995). Institutions realized, however, that "responsibility for instructional quality and control, the improvement of learning, and the aggregate effectiveness of distance education [would] still rest with the faculty" (p. 5). In short, goals resulting from the promise of technology, tied to institutional missions, facilitated a compelling need for a larger faculty development infrastructure (Baiocco & DeWaters, 1995; Lawrence, 1997; Milheim, 2001), and for those managing online course programs, faculty development became a key concern (Milheim, 2001; Zirkle, 2000).

The learner-centered paradigm, increased pressure for reform, and the need for technology training created a persuasive argument for increased emphasis on faculty development (Millis, 1994). In the early nineties, faculty development was still seen in somewhat of a peripheral position within institutions, but this combination of factors

facilitated its movement into an "integrated, better understood, and more centrally located position of importance within the institution" (Gaff & Simpson, 1994, p. 173).

As the 21st century began, clearer visions regarding student learning and the role of technology in higher education were being articulated, and some claim the problems expressed in the early nineties had become more pronounced. Duderstadt (2000) makes the following assertion:

> There is also a rapidly growing gap between today's generation of students and the faculty responsible for teaching them. Today's students come from very different backgrounds than their teachers; they have different intellectual objectives, and they think and learn in different ways. They are far more diverse in every human characteristic – race, gender, nationality, economic background – than the rather homogeneous faculty that teaches them. This mismatch between instructor and student is an important factor in the new tensions surrounding teaching, particularly at the undergraduate level. (p. 22)

According to Duderstadt, Millis' (1994) summation regarding outdated teaching styles and changing student populations had greatly intensified. Others echoed this view in the strongest of terms. Prensky (2001a) states that "today's students are no longer the people our educational system was designed to teach" (p. 1). He specifically sites the rise of technology as the single, greatest reason why such a disconnect exists between faculty and students. In a follow up article, Prensky (2001b) reviews the latest research in neurobiology and argues that due to enormously different socializing experiences during the formative years, today's students actually have different thinking patterns than those

from a decade ago. He calls these students "digital natives" while the faculty who teach them are, at best, "digital immigrants."

These arguments have gained some traction, and as recently as late 2005, the *Educause Review* (vol. 40, no. 5) focused an entire issue on introducing those in higher education to these new students. In it, Oblinger (2005) makes a prediction for the future: "If the current generation of learners differs from faculty and administrators in attitude, aptitude, and knowledge, the odds are that the differences with the next generation of learners will be even more striking" (p. 69). The training required to adequately address these new learner needs presents a formidable faculty development challenge in the years to come.

In addition to growing concerns about students needs and culture, the turn of the century brought with it a number of well-formed rationales for integrating technology into teaching, such as providing students with everyday computer skills for work and life, lowering barriers to access to education, and positively impacting cost structures (Bates, 2000, p. 16); however, by far, the most common argument is to improve student learning (Bates, 2000; Cooley & Johnston, 2001; Duderstadt, 2000; Oblinger, 2005; D. L. Rogers, 2000; Schrum, Skeele, & Grant, 2002; Wilson, 2003). While the financial requirements to stay technologically current present obstacles (Eifler, Greene, & Carroll, 2001), instructional integration has been seen as one of the greatest information technology challenges in higher education over the past six years (computer security overtook instructional integration as the single greatest challenge in 2004) (Campus Computing Project, 2005, October). While it has been found to be somewhat easier to foster adoption of learning technologies within a small group of faculty, scaling up to

widespread faculty adoption has often been elusive. Faculty development strategies to overcome this are needed in the years to come (New Media Consortium and the Educause Learning Initiative, 2006).

Resulting from the demands placed upon institutions by the rapid change in technologies, the perceived evolution of the student population, and the challenges of diffusing the associated innovations, the need and emphasis for faculty development continue to increase. As indicators of this, King and Lawler note that there are increasing numbers of centers, publications, and professional conferences regarding faculty development processes and practices (King & Lawler, 2003). The literature does not suggest a change in this trend.

Range of Focus

The vast majority of the literature pertaining to faculty development focuses on instructional development; however, a number of institutions have implemented programs that serve to diffuse other concepts or types of change within their institution. In addition to instructional development, a review of the literature produces four other conceptions of faculty development: professional, personal, organizational, and curriculum development (Brawer, 1990; Centra, 1978b; Nelsen & Siegel, 1979; Riegle, 1987). These are outlined below.

Professional development, which is often synonymous with career development, emphasizes all aspects of a faculty member's professional life. These programs are often intended to invigorate faculty in their current career stage or to prepare them for the next change in their professional life (Riegle, 1987). To focus on a particular stage, faculty stratification often takes place based upon work experiences which allows developers to

concentrate on themes that are relevant to members of that audience (Finkelstein & LaCelle-Peterson, 1992). New faculty orientation programs are one strata of professional development and are intended to effectively transition new faculty into an institution with the hope of increasing faculty retention and quality (Gaff, 1994; Miller & Nader, 2001). Interestingly, new faculty development appears to have pre-dated instructional development by several years (Centra, 1978a). Professional development programs for senior faculty members have also been offered. The goal of these programs is to revitalize and re-engage those who may have become stagnant in their careers (Baldwin, 1984; Jackson & Simpson, 1993). Programs for junior faculty focus on issues of relevance to the pre-tenured, including the promotion and tenure process, documenting accomplishments, publishing, as well as instructional development (Jarvis, 1991). A new area of professional development recently emerged which focuses on the pre-professoriate. It had been noted that graduate schools have done little to prepare graduate students for the academic profession (Fink, 1992; Gaff, 1994); however, programs intended to prepare the future professoriate are coming into vogue (Gaff, 1994; Kreber, 2001; Travis, Outlaw, & Reven, 2001).

Complimenting professional development, some institutions provide programming that is loosely termed personal development. Personal development is defined as "a direct attempt to increase the self-awareness of faculty as individuals and as people in relationships with others" (Bergquist, Phillips, Quehl, & Bernard, 1981, p. 167). The underlying belief is that the quality of a faculty member's professional output is directly influenced by the quality of his/her personal life (Riegle, 1987). These programs at different institutions have focused on topics as diverse as leadership

development, financial management, career planning, interpersonal skills, personal rejuvenation, and dealing with the death of loved ones (Bergquist et al., 1981; McMillen, 1985; Riegle, 1987; Wilkerson & Irby, 1998). A study in the mid-eighties suggested that approximately one-third of four-year institutions provided this broad type of development, though much of it may be offered via college and university personnel offices (McMillen, 1985).

While professional and personal development concentrate on the individual faculty member, organizational development is concerned with the needs and priorities of the larger institution (Camblin & Steger, 2000). Early on, organizational development was seen as a means to change the university environment for the benefit of teaching and learning (Gaff, 1975); however, as the concept of faculty development has expanded, organizational development is seen as "a long range effort to introduce planned change" concerning a variety of aspects of the institution (Bergquist et al., 1981, p. 183). For Reigeluth and Garfinkle (1994), organizational development is seen as one mechanism through which to enact systemic change. Curricular and instructional changes are not typically considered a part of organizational development (Toombs, 1975); however, faculty working together to change committee procedures, the reward structure, and personnel management guidelines are examples of key organizational development activities (Nelsen & Siegel, 1979).

Curriculum development is seen as having "the greatest impact on the educational process" in higher education (Bergquist & Phillips, 1975, p. 197). It not only involves preparing faculty for upcoming curricular changes, but it also entails evaluating and revising the curriculum (Brawer, 1990; Nelsen & Siegel, 1979). Faculty are seen as

instrumental in this process because their "commitments and capabilities make or break the implementation of curricular change, and they are central to sustaining program vitality" (Association of American Colleges, 1994, p. 44). By engaging in this process, faculty are enriched as they learn more about assessment strategies and experiment with new learning approaches (Jones, 2002). It has been suggested that curriculum development is a conceptual bridge between instructional and organizational development. As faculty move from developing their own instruction to ownership over larger curricular concerns, they begin to have greater influence over their institution (Bergquist & Phillips, 1975).

In addition to these five conceptions of faculty development, it is important to note that there are places in the literature that suggests a comprehensive or holistic approach to faculty development would have the "best chance of creating a transformative gestalt" within an institution (Zahorski, 2002, p. 30). In this model, all of the above conceptions of faculty development along with more traditional forms, such as sabbaticals, travel funding, etc., would be combined into a comprehensive program that would address virtually every aspect of the life of an academic and result in greater institutional transformation (G. Davis et al., 2003; Hubbard & Atkins, 1995; George Watson & Grossman, 1994; Zahorski, 2002).

Best Practices

As noted earlier, faculty development can take many forms, and it is often facilitated via a number of mechanisms; however, one of the most commonly accepted methods is through the creation of what are generically known as *teaching and learning* or *faculty development centers*. A review of the literature provides six broad themes

regarding effective ways to ensure the longevity of these centers as well as best practices to diffuse innovations and affect change in faculty participants. These themes / practices are as follows: institutional issues, adult learning practices, incentives, workshops, integration of peers, and ongoing support. Collectively, it is believed that these themes promote participation, learning, and transfer. A discussion of each of these themes follows.

Institutional Issues. For those concerned with implementing, managing, or directing faculty development centers, sustainability and funding are often the greatest concerns (Bates, 2000; Kelley, 2002; Kobulnicky, 1999). Faculty development is seen as a long term, formative process (Buckley, 2002; Nelsen, 1979); therefore, funding over an extended period of time is required for change to occur. While grants from federal agencies and foundations may get a program off the ground, at some point, the center must transition from grant money to institutional funds (Eble, 1971; Mullally & Duffy, 1978). Further, funding must be adequate to ensure that the chances for center success are not severely diminished (Hammons & Wallace, 1976). Thus, to sustain adequate funding, it is recommended that centers foster positive relationships with multiple stakeholders (faculty, chairs, deans, provosts, etc.). These stakeholders will ensure a broad base of support for the center and can influence top leadership if funding is questioned (S. M. Clark & Lewis, 1985).

Stakeholder support for faculty development centers can be accomplished via a number of strategies. Early successes with a core group of faculty is a fundamental goal, since their personal narratives will underscore the value of the center. This core group will then become advocates for the center and for the population they represent (Staman,

1990). Linking faculty development activities with other change initiatives around campus will also broaden the number of stakeholders and is another way to underscore the value and vitality of the center (Cambridge, 2001; Cannon & Widodo, 1994; Gaff, 1999; Ouellett & Stanley, 1997; Quinlan, 1991). This is especially true for initiatives regarding technology, as it is imperative that the efforts of the center match the equipment and support options available to faculty across campus (O'Bannon, Matthew, & Thomas, 1998).

Obtaining university leadership support is another key ingredient to the success of innovation adoption, change in higher education in general, and faculty development centers (Bell & Bell, 2005; Kirkpatrick, 2001; O'Bannon et al., 1998); therefore, it is essential that the administration see the center as a solution to institutional concerns and that the center's interventions are consistent with the university's overall mission (Reich, 1994). Faculty development centers must be cognizant of institutional goals regarding change and work to develop strategies to meet those objectives (Ducharme, 1981). The support of the administration will logically follow if this is accomplished. Involvement in strategic planning and academic planning efforts are means through which centers can develop a clear understanding of these larger needs and goals (Kobulnicky, 1999; McCredie, 2000; Parker, 1997). A complimentary strategy to understanding institutional needs is to perform recurring needs assessments on the faculty population itself. Recognizing institutional needs as well as the ever changing needs of the population being served enables centers to articulate a clear mission which matches institutional goals and is capable of evolving over time (Halvorson, Thibodeau, & McKenna, 1987; Jackman & Swan, 1994; Shih & Sorcinelli, 1999; Vannatta, 2000).

While there must be a clear link between the center and the institution, it is also argued that the center should not be seen solely as an operation propagating an institutional agenda. Serving faculty needs must be realistically portrayed as the programmatic focus (Halvorson et al., 1987; Hammons & Wallace, 1976). With regard to technology, it is also recommended that centers avoid embracing a sole focus on solving technical issues and that technology for technology's sake should not become the dominant focus (Chizmar & Williams, 2001). This suggests that an emphasis upon solving faculty needs in general is the ideal approach, thus further ensuring the perception that the center is adding value to the institution. Gandoflo (1998, p. 31) posits this summary regarding instructional technology: "Change will occur if the introduction of technology is guided by an institutional vision for its use in teaching and learning that is rooted in sound instructional principles." Here, technology adoption is framed as a solution to multiple needs rather than the overall goal.

Ongoing programmatic evaluation has been asserted as another method for ensuring that center offerings match the needs of the faculty (Jackman & Swan, 1994; J. F. Moore & Head, 2000; Nelsen & Siegel, 1979; Reich, 1994). Evaluation is also seen as a means for providing evidence regarding the value of the center (Gaff & Morstain, 1978). By collecting and sharing data regarding successes, balancing activities between institutional goals and faculty needs, linking actions to other change initiatives, and fostering positive relationships with stakeholders, centers can become institutionalized and ensure a prolonged existence. In short, this combination enables faculty development centers to provide a compelling rationale for their existence, the lack of which has been cited as the number one reason why they fail (Hammons & Wallace, 1976).

By sustaining a program over time, a faculty development center can have the opportunity to position itself within an institution in a way that will allow it to promote significant change; however, regarding individual adoption, Wlodkowski (2003) posits that motivation, participation, and the transfer of learning must be fostered to enable faculty development centers to produce change within individual adopters. The remainder of this section provides practices that address these concerns.

Adult Learning Practices. One criticism of faculty development programs previous to the 1990s is that they offered superficial experiences and lacked a theoretical framework on which to structure learning activities (Levinson-Rose & Menges, 1981; Weimer & Lenze, 1991). In response to this criticism, it has been posited that the integration of adult learning principles will provide a meaningful foundation on which faculty development practices can be assuredly grounded (Cranton, 1994; Lawler & King, 2000; Licklider, Fulton, & Schnelker, 1997).

In Knowles, Holton and Swanson's (1998) seminal work, *The Adult Learner*, key adult learning assumptions are summarized (p. 40):

1. Adults are motivated to learn if the content is relevant and can satisfy current needs;
2. Adults approach learning from a life-centered perspective;
3. Adults prefer and find experiential learning to be the richest;
4. Adults prefer learning opportunities that are self-directed; and
5. As adults age, the differences between them increase.

Based upon these principles and considering characteristics of faculty in higher education, Lawler and King offer six strategies, rooted in adult learning principles,

specifically intended to guide faculty developers. They state that faculty developers should “create a climate of respect, encourage active participation, build on experiences, employ collaborative inquiry, [offer practical strategies], and empower participants” (2000, pp. 21-24). A review of the principles asserted by both Knowles et al. (1998) and Lawler and King (2000) reveals the thematic significance of self-directed learning. Conceptually, then, a self-directed model of faculty development provides an environment in which “faculty will initiate efforts to improve, will make their own decisions about what they want to learn and how learning should occur, and will pursue learning apart from sponsored efforts” (Licklider et al., 1997, p. 122). Given this view of faculty as intrinsically-motivated and self-directed, it is argued that faculty development should never be compulsory as it will likely result in frustration and resentment (Hammons & Wallace, 1976; Knowles et al., 1998; Kreaden, 2001; Morrison, 1992).

In contrast, Cranton (1994) and Cranton and King (2003) posit that a self-directed model may assume too much of faculty; while adult learners are self-directed in principle, their direction may not be in the areas where development is needed. In order for the faculty and the developers to work toward a common goal in relation to the content in question, Cranton, drawing upon Mezirow's (1991) Theory of Transformative Learning, asserts that a significant goal of faculty development is to foster the *characteristic* of self-directedness. To meet this objective, some faculty may be challenged to transform their "basic assumptions about themselves as learners, the role of the teacher, [and] even the goal of education" (1994, p. 729). For Cranton (1994), self-directed / transformative faculty development, born from adult learning principles, would include practices such as active learning, collaborative inquiry, role playing, simulations, case studies, and

reflective practice. Reflective practice, an implementation of self-reflection, is seen as the key mechanism through which faculty develop self-direction and ultimately transform their assumptions and beliefs regarding learning and education (Brookfield, 1995; Cranton, 1994; Cranton & King, 2003; King, 2001; Licklider et al., 1997). Through the self-reflective process, faculty question their current practice and begin to seek ways to increase their effectiveness (Cranton, 1994; Licklider et al., 1997). In the self-directed and transformative model of faculty development, developers would still be participatory but less overtly directive than in the past. Cranton (1994) also underscores the need for longer-term development activities, since transformative learning, like most forms of change, requires time.

Incentives. While some faculty are intrinsically motivated to attend training and engage in instructional improvement activities, it is unlikely that a majority of the faculty will participate in these activities without appropriate rewards and incentives (Friedheim & Jaffe, 1999). The literature provides a lengthy list of faculty development incentives that have been employed in higher education. They include

- Grants (Camblin & Steger, 2000; Chait & Gueths, 1981; Chizmar & Williams, 2001; S. Cohen & McMullen, 2000; Faulkner, 1987; Group for Human Development in Higher Education., 1974; Jacobsen, 1989, March; Levinson-Rose & Menges, 1981; Poplin, 2003; Weimer & Lenze, 1991),
- Equipment (Chait & Gueths, 1981; Chizmar & Williams, 2001; Irani & Telg, 2001; J. F. Moore & Head, 2000; Shih & Sorcinelli, 1999),
- Awards, status, and other forms of recognition (Chait & Gueths, 1981; Ellis, 1993; Frayer, 1999; Howell, Saba, Lindsay, & Williams, 2004),

- A load reduction / release time (Chait & Gueths, 1981; Chizmar & Williams, 2001; Howell et al., 2004; Irani & Telg, 2001),
- Merit pay / stipends (Chait & Gueths, 1981; Frayer, 1999; Howell et al., 2004; Irani & Telg, 2001; Wildman, Hable, Preston, & Magliaro, 2000),
- Graduate assistant support (Chait & Gueths, 1981; Irani & Telg, 2001),
- An increased library budget (Chait & Gueths, 1981),
- Travel funds (Chait & Gueths, 1981), and being
- Allowed to teach more advanced courses (Chait & Gueths, 1981).

It is interesting to note that Giannoni and Tesone (2003) found that senior faculty were less influenced by extrinsic rewards than junior faculty; however, when considering instructional technology, a blend of intrinsic and extrinsic rewards resulted in greater participation.

While the aforementioned incentives have been shown to increase faculty participation in development and subsequent course revision activities, the larger institutional rewards system is often cited as the core reason why teaching excellence and innovation are neglected by faculty in the first place (Chism, 2004; Eble, 1971; K. L. Smith, 1997). As a result of the technology revolution and the WWW, interest in the revision of promotion and tenure criteria grew in the mid to late 1990s (e.g., Chizmar & Williams, 2001; Frayer, 1999; Lieberman & Guskin, 2002; K. L. Smith, 1997); however, the few changes that were made did not significantly alter these criteria at most institutions (e.g., Frayer, 1999). Further, the literature suggests that the promotion and tenure process is unlikely to see significant changes in the foreseeable future.

Workshops. From the earliest days of modern faculty development, "the workshop [has been] the main staple in the instructional improver's cupboard" (Weimer & Lenze, 1991, p. 656), and this continues to be the case (Cranton, 1994). As a result of the rise of the WWW and the instructional strategies that it enables, new training topics have arisen over the past 15 years that pertain to computer skills (D. L. Rogers, 2000). Faculty development addressing technological concerns is and will be an ongoing challenge in higher education in the years to come (Gaff, 1999).

Unsurprisingly, Mayes (1993) found that teaching computer skills alone, even for information management and document distribution, did not translate to improved student learning. Therefore, it is widely recommended that most faculty development technology workshops be coupled with educational theory in the context of instructional practice (Beaudoin, 1990; Cagle & Hornik, 2001; Littlejohn, 2002; Marx, 2005; R. M. Smith & Stalcup, 2001). It is also recommended that faculty development centers take care to ensure that the technologies they promote and teach are adequately supported on their campus (Cagle & Hornik, 2001). While workshops can take many forms, "long term effectiveness generally has not been found for workshops of short duration, less than one day, with little or no follow up" (Sunal et al., 2001, p. 248). With that said, faculty attitudes, knowledge, and classroom practice have been significantly changed by multi-day programs using follow up techniques (Herr, 1988; Long, Sadker, & Sadker, 1986).

While instructional design and teaching models, such as the ADDIE model (Gustafson & Branch, 2002) and Gagné's Nine Events of Instruction (Gagné & Medsker, 1996), provide valuable guidance that can be employed in all educational settings including faculty development workshops, Wlodkowski (2003) and Wlodkowski and

Ginsberg (1995) posited their Motivational Framework for Culturally Responsive Teaching, an approach specifically customized to meet needs in the professional development setting. This framework incorporates best teaching practices and adult learning theory "to foster participation, learning, and transfer throughout a professional development program" (Wlodkowski, 2003, p. 39). Because of this synthesis, this framework presents somewhat of a culmination of pre-existing theory and practice. Intended specifically for the workshop environment, this model offers four guiding principles for instructors to employ in an effort to foster greater intrinsic motivation and learning among participants.

The first of these principles is to establish inclusion. Wlodkowski (2003) recognizes that participants in faculty development workshops are often less receptive to content because they don't necessarily see a value in it at a given time. Workshops focusing on technological innovations are cited as a common example of the phenomenon. Wlodkowski recommends setting a welcoming tone of inclusion and fostering a climate of respect. Within this context, "intrinsic motivation can emerge because people can be authentic and voice relevant concerns" (2003, p. 41). Collaborative learning, multidimensional sharing, and the clear articulation of participation guidelines are cited as examples of strategies that help to establish inclusion.

Attitude development is the second guiding principle of the Motivational Framework for Culturally Responsive Teaching workshop model. "The pragmatism of most adults makes personal relevance a key ingredient in developing a positive attitude at the outset of a professional development program" (Wlodkowski, 2003, p. 43). Employing learning models, such as peer modeling, is one strategy to establish relevance

and foster a positive opinion about the workshop. The K-W-L strategy, which asks participants what they know about a topic, what they want to know, and finally, what they've learned, is another way to foster participant interest.

The third principle of Wlodkowski's (2003) model is the implementation of strategies that enhance and deepen learning. The goal here is to offer meaningful and challenging learning experiences that speak to the individual needs and values of each participant. Problem-based learning, role-playing, exercises, and games are offered as examples of instructional strategies that increase intrinsic motivation and deepen learning by allowing participants to bring their values and perspectives to the learning activities.

Finally, engendering participant competence is the fourth principle of the Motivational Framework for Culturally Responsive Teaching. This can be accomplished via authentic assessments that allow participants to perform the tasks or skills they were being taught. By doing so, participants will be able to "organize what they are learning and clarify how to apply it to their real-world situations" (Wlodkowski, 2003, p. 45). At this point, it is important to note that many of the instructional strategies recommended by Wlodkowski are the same as those recommended by Cranton (1994) to foster transformative learning and self-direction over time. These two theories, informed by adult learning theory, compliment one another.

While Wlodkowski's (2003) four principles offer guidance for providing a satisfying workshop experience for faculty, like Cranton, he also recognizes that change requires time. He posits that peer mentoring experiences within and beyond the workshop are needed to deepen the ability of participants to apply new knowledge. Due to reciprocity, reflection, shared experience and an authentic learning environment,

peering mentoring within the faculty member's own work setting is likely to increase the transfer of this new knowledge. The literature is rich with guidance regarding the use of colleagues and peers in faculty development activities.

Integration of Peers. Faculty colleagues and peers working with each other for the purpose of faculty development was not often used in the 1960s and 1970s; however, budget constraints and staffing issues soon challenged faculty development centers, and faculty volunteers were sought to assist with programming. Serendipitously, as a result of this recruitment, it was discovered that utilizing faculty in this context was exceptionally effective (Weimer & Lenze, 1991). Over the past two decades, several strategies have emerged that effectively utilize and integrate faculty peers. The use of peer mentors and the facilitation of learning communities are two of the most common.

Mentoring among faculty members has emerged as a popular faculty development strategy (L. D. Goodwin & Stevens, 1998) and refers to a one-on-one relationship between a more seasoned or skilled faculty member and one possessing less experience. This often involves senior faculty assisting the growth of junior faculty (Angelique, Kyle, & Taylor, 2002; Boice & Turner, 1989; Luna & Cullen, 1995; Sands, Parson, & Duane, 1991; Sullivan-Catlin & Lemel, 2001); however, due to the rise of the WWW, those who are deemed early adopters of technology are often matched up with protégés with novice technological skills, and faculty rank is often not the defining stratification in these mentoring relationships (Diehl & Simpson, 1989; Frayer, 1999). Specific mentoring strategies include observing each other teach with follow up (DeZure, 1993; Weimer & Lenze, 1991), developing strategies in response to student evaluations (Jackman & Swan, 1994), and sharing best practices regarding the use of technology (Marx, 2005). It is also

important to note that a key component of successful peer mentoring in higher education is confidentiality (Cox, 1999; Elmore, 1983, April).

Research has shown that "mentoring in general, and academic achievement in particular, is positively correlated with achievement and success" (Diehl & Simpson, 1989, p. 148) and underscores the logic behind its implementation in higher education. While the limited number of studies pertaining to peer mentoring specifically in higher education have shown this practice to be effective (P. A. Cohen, 1980; Menges & Brinko, 1986, April), individual meetings and follow ups are unfortunately labor-intensive and difficult to scale up (Gillespie, 1998b; Wilhite, Lunde, & Latta, 1999). Learning communities of faculty can be seen as a compliment to or an extension of the peer mentoring concept and provide the ability to reach more faculty with fewer resources.

Learning communities, also known as communities of practice, faculty study groups, faculty inquiry groups, and teaching circles (P. D. Sherer, Shea, & Kristensen, 2003), are seen as inexpensive ways to leverage "a teaching improvement center's resources, [make] innovative teaching visible, and [provide] peer models to other faculty while helping [to] promote an overall institutional culture that actively supports teaching excellence" (Wilhite et al., 1999, p. 182). As an overall best practice, the literature suggests that group sizes should not exceed 15; however, fewer than that is ideal (Cox, 2000; Mewborn et al., 2002; Wildman et al., 2000).

Faculty developers who wish to foster learning communities must identify a critical set of issues around which to engage interested faculty. Change is then made possible by enabling and encouraging members of this community to discuss and reflect upon these issues and share their personal experiences. Within the learning community

framework, faculty development centers become facilitators of this process by arranging meetings, posing thoughtful questions, and managing other logistical considerations (Chism, Lees, & Evenbeck, 2002; Wildman et al., 2000). While a variety of interactions can take place within learning communities, the core activity is that of reflection upon the critical set of issues (Killen & Killen, 1992; Wildman et al., 2000). As mentioned above, reflection is a key adult learning process that fosters self-direction with the aim of changing faculty assumptions, beliefs, and practices regarding learning and education (Brookfield, 1995; Cranton, 1994; Cranton & King, 2003; King, 2001; Licklider et al., 1997) and learning communities are another means of encouraging reflection.

While peer mentors and learning communities are an effective means of fostering self-directedness, change is certainly not instantaneous. Therefore, in addition to incentives, workshops, and peer interaction, ongoing assistance is needed to support the change efforts of faculty development programs (Buckley, 2002; Licklider et al., 1997).

Ongoing Support. Faculty development centers offer a range of opportunities that are intended to provide "just in time" support for faculty. One of the most popular strategies is the consultation (Centra, 1978b; Fink & Bauer, 2001). Like peer mentoring, consulting can be exceptionally time-consuming, yet faculty and consultants alike find this to be an effective and rewarding approach. Through a welcoming, customer-oriented methodology that encourages multiple sessions, faculty interest can be sustained over a long period of time (Bell & Bell, 2005; Lewis, 2001). This supports the formative process that underlies real changes in practice (Buckley, 2002). It can also support the continued usage of an innovation after its initial adoption (Bell & Bell, 2005).

Lewis (2001) suggests that faculty development consultants wear a variety of hats to meet the diverse needs of their constituents. They include data collector, data manager, facilitator, support system, counselor, and information source. Depending on the scope of the faculty development center, researcher and technology specialist might also be added to this list (Irani & Telg, 2001; Shih & Sorcinelli, 1999; Weimer & Lenze, 1991). As with peer mentoring, confidentiality is seen as a key concern for those engaged in faculty development consulting (Fink & Bauer, 2001).

In addition to one-on-one assistance, a number of other strategies for ongoing support have been recommended and implemented. They include the usage of teleconferences (Cooley & Johnston, 2001; Frayer, 1999; Hartman & Crook, 1997), web-based training, resources, and consulting (Chizmar & Williams, 2001; Cooley & Johnston, 2001; Donovan & Macklin, 1999; Hons, 2002; Kauffman & Knight, 2004; Kelley, 2002; Poplin, 2003; St-Pierre, 1999; Taylor, 2003), brown-bag lunch discussions to supplement workshops (Gandel & Golden, 2004; Topp, 1995), technical support help desks (Engeldinger & Love, 1998), easy access to facilities and equipment (Eifler et al., 2001; K. L. Smith, 1997), scheduled computer renewal (J. F. Moore & Head, 2000), and production support (Feist, 2003). Many of these strategies involve collaborations with other units on campus. Leveraging expertise from across the institution is an excellent way to cultivate a robust set of ongoing support options for faculty.

In summary, a faculty development program that strives to implement the six best practices outlined above are likely to ensure sustainability, encourage participation, deepen learning, and increase transfer. Utilizing adult learning principles, providing incentives that increase motivation, offering relevant workshops, facilitating meaningful

peer interaction, encouraging reflective practice, and providing ongoing support are the keys to successful faculty development.

Overview of Areas of Research

Undoubtedly, the literature concerning faculty development in higher education is voluminous; however, an in depth review reveals that it is mostly comprised of position papers, case studies, program evaluations, proposed faculty development models, historical overviews, survey data, recommendations for practice, and descriptive statistics. Unfortunately, "there is a paucity of experimental research on the effects of teaching-improvement interventions" (Wilkerson & Irby, 1998, p. 390). Similar observations regarding the general lack of empirical study of faculty development have been made often over the past 25 years (Chism & Szabo, 1997; Eash & Lane, 1985; Levinson-Rose & Menges, 1981; Stratos, Bergen, & Skeff, 2004; Weimer & Lenze, 1991).

In addition to this lack of empirical study, the quality of the methodologies that have been employed have also been questioned (Levinson-Rose & Menges, 1981; Weimer & Lenze, 1991). Few of these methodologies include an explicit articulation of their underlying principles and assumptions, sparking the recommendation that future studies clearly state the theoretical or conceptual bases on which they are grounded. The general lack of sophistication and depth of exploration employed by most of these studies is also cause for concern. As an example of this flaw, it is noted that self-reported perceptions and attitudes don't necessarily translate to changes in practice; however, studies concerning developer and faculty perceptions are common (Levinson-Rose & Menges, 1981; Weimer & Lenze, 1991). Further, while affecting practical change is a

goal for faculty development programs, the ultimate goal, in the context of instructional development, is an improvement in student learning. This higher objective is certainly a difficult phenomenon to study.

In an attempt to better organize and legitimize research practices for measuring the success of faculty development programs, a research agenda for faculty development in medical schools has been posited that stratifies this research into four areas (Stratos et al., 2004). The larger institutional environment in which faculty development programs exist is the focus of contextual research, whereas research on topics speaks to selecting content that is the most relevant for delivery to faculty. Studies concerning faculty, such as their needs and characteristics, provide the basis for participant research, and process research speaks to the practices and interventions employed by faculty development programs. Although there is some conceptual overlap between context, topics, participants, and process, this proposed agenda for the future of faculty development research provides a useful rubric for considering past research as well.

While contemporary faculty development research is dominated by studies concerned with process and participants, much of the first decade of research into faculty development was concerned with contextual issues. Survey instruments resulting in descriptive statistics were the method of choice at that time, and given the little data that existed regarding faculty development, this approach helped develop a much needed framework of understanding on which faculty development programs could be designed.

Exemplary of this early contextual research is the work of Eble and Gaff. Eble (1971), through a survey distributed as an insert in the journal *Academe*, collected data on the policies and practices in higher education that were detracting from teaching and

learning and discouraging instructional development. Gaff's (1975) study, funded by the Exxon Foundation, provided descriptive statistics regarding the number of faculty development programs in higher education and how they were constructed in response to local and national trends and pressures. These studies established an understanding of the institutional issues that were influencing the growth of faculty development.

More recently, studies concerned with context, coupled with an interest in discerning the most relevant development topics, have emerged, largely due to pressures placed upon institutions by the rise of the WWW. Survey instruments resulting in descriptive statistics were again the method of choice. The foci for these recent studies include how new instructional technology topics are forcing centers to reorganize or alter their services (Grill, 1998; Taber, 1998) and how budgets, staffing, compensation, and resources have changed due to this restructuring (Dickinson, Agnew, & Gorman, 1999; Wright, 1999).

As mentioned earlier, participant and process studies comprise the bulk of faculty development research. Research regarding participants usually seeks to learn more about that audience, and a number of different angles have been used to gather this information. One of the earliest such studies, again using surveys to collect data, sought to determine demographic information regarding faculty who chose to participate in faculty development (Centra, 1976). Stratifications were made based on faculty rank and type of institution. Around this same time, Sachs (1976), looking at 375 faculty at Michigan State University, sought to determine characteristics of innovators and non-innovators. Based upon three stratifications (innovators receiving support via instructional development grants, innovators lacking the benefit of support, and non-innovators who

have neither of the innovator experiences), Sachs used a survey instrument to determine on which characteristics these groups significantly differed. Many of the characteristics, such as innovativeness and cosmopoliteness, were derived from Rogers (2003). Multiple regression was used to develop a predictive equation that could be used to analyze faculty not participating in this study. Sachs' research represents one of the earliest, quantitative studies regarding participants of faculty development.

A number of studies have been completed over the years that simply sought to determine the needs and attitudes of faculty in relation to faculty development programming (Botman & Gregor, 1984; Eleser & Chauvin, 1998; Inman & Mayes, 1998; Parry & Wharton, 1995). In addition to providing valuable needs assessments data, these survey studies also looked for significant differences along demographic lines, such as age, gender, race, and faculty rank, though some simply provided the results without statistical analysis (e.g., Chizmar & Williams, 2001).

Qualitative methods with small samples of faculty have recently been used as a means to gain in depth knowledge regarding specific faculty attitudes and perceptions. Examples of this type of participant inquiry include the following: ten faculty were asked open ended questions to determine the scope of and the relationship between their teaching changes and the center that supported them (Stanley, 2000); ten faculty were interviewed to garner in depth information about faculty experiences and opinions regarding online course development (Feist, 2003); and twenty humanities faculty participated in focus groups to discuss their technology skills and related concerns and interests (Massey-Burzio, 1999). Each of these studies resulted in rich narratives regarding faculty needs, perceptions, and attitudes; however, these results are somewhat

limited due to the sample size. Mixed methods have also been used to look at these same sets of issues (e.g., Schrum et al., 2002)

Maybe the most valuable reason for research into context, topics, and participants is that this data can be used to inform the practices, interventions, and processes employed by faculty development programs. Via mass-mailed surveys, there have been periodic attempts to collect information about policies and practices throughout higher education (e.g., Centra, 1976; Chambers, 1998; Erickson, 1986). For the most part, it can be assumed that the practices reported, however, represent their perceived-effectiveness by the developers who responded to the survey, though some evaluation by those employing these practices could also be assumed. There have also been studies that have looked at the perceived-effectiveness of faculty development strategies from the perspective of the faculty (e.g., Banks, 2002; Mbuh, 1993; Montgomery, 1990; Sprenger, 1999); however, the more valuable (and difficult) research question concerns the actual, proven effectiveness of these strategies have not been empirically studied. While there is little experimental research into the effectiveness of faculty development practices,

> there is a growing body of quasi-experimental and qualitative research demonstrating the efficacy of longer workshops, students' ratings coupled with individual consultations, and faculty development fellowships. Research on these interventions have been measured by changes in teachers' knowledge as assessed by self reports, test and observations; teachers' skills as documented by observations; teachers' attitudes and self-efficacy as measured by self-reports; students' attitudes based upon self-reports; and students' learning as measured by examinations (Wilkerson & Irby, 1998, p. 390).

There are very good reasons why quasi-experimental and qualitative research methods have been employed to study faculty development.

Because of the near impossibility of random assignment of faculty to workshops due to their professional autonomy, quasi-experimental designs are often the only option for studying some practices. As an example of this type of research, one study looked at the practice of workshops and their impact on faculty computer self-efficacy (Faseyitan, Libii, & Hirschbuhl, 1996). In it, funding was used as an incentive to entice faculty to participate in technology-focused workshops intended to change instructional practice. At an institution with approximately 280 faculty, 66 chose to attend the training. A post-test designed to determine changes in self-efficacy was sent to those 66 with 56 percent (37) responding. Analysis found that self-efficacy had significantly improved due to the training; however, due to the initial lack of randomization, the likelihood that those with low computer self-efficacy avoided the workshops, and the possibility that survey non-respondents were simply dissatisfied with the training, the results of this study, while providing direction for future studies, are somewhat suspect.

Wilkerson and Irby (1998) also mentioned that an increasing number of qualitative studies were exploring faculty development practices. One such recent study sought to determine if involvement in faculty development could facilitate transformative learning (Whitelaw, Sears, & Campbell, 2004). Out of 48 participants in a faculty development program, only nine chose to participate in follow up interviews. Based on the analysis of the researchers, only two experienced a true transformation in teaching practice, while three more showed some indications of change. Unfortunately, because of the low percentage of those participating in the focus groups (18 percent) as well as the

small overall sample size, concerns about the generalizability of these qualitative findings arise.

Projecting into the future, quasi-experimental designs are likely to persist in faculty development research because of the mores of higher education. Qualitative research also has growing opportunities for contribution, as studying complex constructs, such as transformative learning, are surely informed by exploratory, in depth methods of inquiry.

Summary

Simply put, faculty development programs in higher education are institutional interventions intended to facilitate change toward a complex ideal regarding a number of aspects of a faculty member's professional life. A consideration of current trends in higher education provides an overview of the specific types of changes that faculty development programs are charged with fostering.

Cognitive research offers new views of learning, learner-centered instruction is emphasized, and the WWW presents new challenges for faculty development (Bates, 2000; Fulton et al., 1997; Milheim, 2001; Zirkle, 2000). Most recently, the belief that higher education uses strategies that no longer match the learning skills and needs of students adds additional dimensions to instructional development (Duderstadt, 2000; Millis, 1994; Oblinger, 2005; Prensky, 2001a, 2001b).

While faculty development interested in changing teaching practice is, by far, the most common form of development, there are other foci as well. They include professional, personal, organizational, and curriculum development (Brawer, 1990; Centra, 1978b; Nelsen & Siegel, 1979; Riegle, 1987). All five conceptions of faculty

development employ strategies and interventions to bring about change. The literature offers six faculty development best practices which include managing institutional issues, incorporating adult learning principles, offering incentives for participation, delivering workshops, integration faculty peers, and providing ongoing support. The literature also offers a stratification of areas of research into faculty development. They are context, topics, participants, and process (Stratos et al., 2004). From an investigative perspective, practices can be viewed as treatments, and this provides a familiar rubric for researchers; however, little experimental research into the practices employed by faculty developers has been completed (Wilkerson & Irby, 1998). With that said, quasi-experimental and qualitative research methods are quite popular forms of inquiry into the effectiveness of faculty development practices (e.g., Faseyitan et al., 1996; Whitelaw et al., 2004).

At this point in this literature review, a clear connection between faculty development and diffusion studies has not been overtly developed. The following section provides a framework through which faculty development can be viewed, in a classical diffusion of innovations sense, as an agent of change.

Synthesis: Faculty Development as an Agent of Change

There are only a few places in the faculty development literature where the term *change agent* is used to describe faculty development programs in higher education (e.g., R. H. Davis, 1979; Jones, 2002; Zahorski, 2002); however, there is true value in making a clear, conceptual connection between the two. First, by situating faculty development within a diffusion of innovations conception of change agent, a reasonable justification emerges for generalizing notions of change agents, as outlined in that body of literature, to the field of faculty development. One can then compare the roles and practices of

faculty development to those of change agents, and by doing so, current best practices can be somewhat validated. Further, faculty development researchers may generalize the findings of change agent studies to faculty development, seek to replicate those findings within the context of faculty development, and/or discover new lines of inquiry altogether. With that said, the aforementioned connection is outlined below.

Conceptual Connection

Rogers defines change agent as someone either internal or external to a social system, "who influences clients' innovation decisions in a direction deemed desirable by a change agency" (E. M. Rogers, 2003, p. 366). While outside consultants are sometimes employed for specialized faculty development assistance, survey research into faculty development practices shows that most programs and centers are funding and situated within the college/university they serve and would therefore be viewed as internal to the institutional social system (Centra, 1976; Chambers, 1998; Erickson, 1986). As a first step toward making the change agent connection, it is accurate to conclude that faculty development is a mechanism internal to institutions.

Historically, faculty development programs have been responses to growing institutional (change agency) needs. The purpose for their creation was to provide a mechanism for responding to these needs by fostering change(s) or diffusing innovative teaching practices to the institution's faculty (clients) (Gaff & Justice, 1978). Some faculty development theorists have underscored the challenge of being positioned between the administration and the faculty. To ensure their longevity, faculty development programs and centers have to make certain that their activities support institutional goals (Ducharme, 1981; Reich, 1994) but also foster the perception that they

exist to support faculty needs (Halvorson et al., 1987; Hammons & Wallace, 1976). In Gaff and Simpson's (1994) estimation, by the 1990s, faculty development, in general, shifted somewhat so that it was more directly driven "by the needs of faculty than by the design of administrators" (p. 171), but there is clearly an attempt to serve both.

A parallel tension is expressed in the internal change agent literature. Rogers (2003) states that while the change agency dictates the larger adoption goals, the change agent must also determine the client's actual needs and mediate between the two. As a result, change agents must act as advocates for the clients and work to develop solutions that meet their needs while also advancing the larger change goals provided by the change agency. As noted above, faculty development does just that. The conceptual overlap between the positioning of faculty development within institutions and the descriptions of internal change agents is nearly identical. As such, it is accurate to conclude that faculty development programs and centers are excellent examples of internal change agents as defined in diffusion and change agent literature.

Shared Strategies

According to Rogers (2003), the overarching goal of change agents is to foster *innovativeness*. Several theorists have offered strategies which sought to engender this characteristic, and encourage adoption and change, within the target population (see Guba, 1968; Guba & Brickell, 1974; E. M. Rogers, 2003; Zaltman & Duncan, 1977). The predominant theme across these change agent strategies is an emphasis on communication and interaction with clients. Change agent research has further determined that ensuring change agent contact with clients, either face-to-face or through additional communication channels, and tailoring interaction strategies to meet specific

client needs are the most effective strategies (Foster, 1968; Purdy, 1968; E. M. Rogers, 2003).

An overview of the best practices of faculty development reveals that most are consistent with the suggestions from change agent literature. Incorporating adult learning practices and stratifying audience based upon career stage or technological skill level are faculty development efforts to customize and tailor its message to characteristics of its audience. Incentives, workshops, ongoing support, and the integration of peers are attempts to ensure meaningful and continuing contact with clients. Generally speaking, faculty development employs practices that are consistent with guidance provided by the change agent literature; however, several practices from existing change agent models, such as increasing disequilibrium within adopters to strengthen the desire to adopt (Havelock & Zlotolow, 1995; E. M. Rogers, 2003), offer areas of consideration for future faculty development practices.

Shared Research Areas

While the practices recommended for change agents and faculty developers are theoretically informed, one common criticism of both fields is that empirical research into evaluating the resulting effectiveness of these strategies has not been thoroughly undertaken (Chism & Szabo, 1997; N. K. Clark, 1978; Eash & Lane, 1985; Levinson-Rose & Menges, 1981; Stratos et al., 2004; Weimer & Lenze, 1991; Wilkerson & Irby, 1998). In addition to determining measures for effectiveness, researchers in both fields have recommended inquiry into the underlying psychological factors of adoption, such as attitudes, motivation, and self-efficacy, as that knowledge will further explain the success

of strategies as well as provide direction for the creation of new strategies (Vance, 1980; Wilkerson & Irby, 1998).

Direction for both fields can be found in the research of overt behavior change, as it suggests that strategies fostering motivation and self-efficacy are also likely to increase the rate of adoption (DiClemente et al., 1991; Galavotti et al., 1995; Marcus et al., 1992). While a line of inquiry into motivation and self-efficacy, especially computer self-efficacy, in relation to faculty and training has begun (e.g., Dusick, 1998; Faseyitan et al., 1996; Kagima & Hausafus, 2000; Parry & Wharton, 1995; Sunal et al., 2001), overt behavior change literature suggests that there should be greater interest in how interventions and practices can influence faculty self-efficacy in relation to advocated innovations and changes. To assist with this research, Pajares and Miller (1994) offer the following guidance for continuing this line of inquiry: "self-efficacy must be specifically rather than globally assessed, must correspond directly to the criterial performance task, and must be measured as closely as possible to the time of task" (p. 194).

Influence from Diffusion Theory

Accepting that faculty development is indeed an agent of change also encourages a consideration of the relationship between diffusion studies and faculty development. While limited, there are places in the faculty development literature that have embraced specific diffusion concepts and language. Rogers' (2003) adopter categories (innovator, early adopter, early majority, late majority, and laggards) as well as the term *opinion leader*, are often used to describe members of faculty populations, especially in relation to the adoption of technology. (e.g., Baldwin, 1998; Buckley, 2002; Feeney, 2001; Galavotti et al., 1995; Kahn & Pred, 2001; Kobulnicky, 1999; Middendorf, 1999).

Bennett and Bennett (2003) recently studied the characteristics of technologies that influence faculty adoption decisions, and the diffusion of innovations was used as the framework for this research. The results of this study were then applied to the design of faculty development workshops.

In addition to these examples of diffusion concepts and language within faculty development, it should again be noted that CBAM was developed via a synthesis of diffusion theory and other research and has been used successfully for faculty development purposes (Holloway, 1996). This is not surprising, as CBAM was designed for applications within the context of education and is dependent upon the facilitation of a change agent. Within this context, faculty developers collect and mediate the concerns confided by faculty for the purpose of managing the change process and moving faculty through the stages of concern toward adoption (Lee & Lawson, 2001; Slater, 1991). Research has shown that faculty development best practices, such as workshops and ongoing support, also encourage movement through the stages of concern (Matthew, Parker, & Wilkinson, 1998). CBAM has also been used as a means for designing faculty development and associated support programs to ensure that they address the concerns articulated by faculty (Signer, Hall, & Upton, 2000) and surely provides an area of continued inquiry for faculty development researchers.

In addition to these current areas where the diffusion of innovations has been incorporated into faculty development practices, diffusion studies offers several “classic” areas of research, including perceived attributes of innovations, adopter categories, rate of adoption, and the innovation-decision process. These lines of inquiry may provide

additional frameworks through which to pursue a faculty development research agenda such as the one outlined by Stratos et al. (2004).

Summary

In summary, as conceptualized by Rogers (2003), faculty development within higher education provides an exemplary illustration of how an internal change agent should function. As a result, comparing change agent practices with faculty development practices offers an additional lens through which to confirm the approaches being used in programs and centers in higher education. While this is valuable, research into the effectiveness of these strategies, as well as the underlying psychological factors influencing adoption, is still needed. Outside of CBAM and a few common terms, faculty development literature has developed language and lines of inquiry that, for the most part, are not directly associated with diffusion theory. With that said, given the conceptual placement of faculty development as a change agent within the diffusion of innovations framework, research areas common in diffusion studies, such as perceived attributes of innovations, adopter categories, rate of adoption, and the innovation-decision process, might also prove to be valuable lines of inquiry for those interested in faculty development.

Overall Summary

Because accelerating change is seen as an escalating challenge for higher education (Duderstadt, 2000), and because faculty development is situated in higher education as an institutionalized means through which change is fostered (Chait & Gueths, 1981; Gaff & Simpson, 1994), there is significant value in considering faculty development through research and through alternative lenses at this point in time. In

general, faculty development has developed language and theories which make little explicit reference to the work of change agents and diffusion researchers; however, these additional lenses provide greater understanding regarding the process of change and innovation adoption. This review of relevant literature provides a foundational understanding regarding diffusion studies, change agents, and faculty development within higher education. Below is a summary of the key points found in this body of literature.

Regarding diffusion studies, Rogers' (2003) influence is felt within all disciplines within the larger field. He states that all diffusion campaigns contain the same four, universal elements and his definition of diffusion reflects this: "The process in which an innovation is communicated through certain channels over time among the members of a social system" (p. 5). Rogers also describes an innovation-decision process consisting of five stages: knowledge, persuasion, decision, implementation, and confirmation. Rate of adoption is something diffusion theorists desire to predict and increase, and Rogers (2003) posits that the following contribute to adoption rates: perceived attributes of the innovation, adopters' role in the decision to adopt, social system dynamics, effectiveness of communication channels, the strength of the adoption need, and the effectiveness of change agent efforts. Adopter characteristics are also seen as key, and Rogers identifies five adopter categories (innovators, early adopters, early majority, late majority, and laggards) to which he made generalizations about personality, socioeconomic status, and communication characteristics. From this basis, the literature provides theories and suggestions for those facilitating the change process. Social system-specific diffusion theories have also emerged from Rogers' foundational principles.

Rogers (2003) defines a change agent as an individual, either internal or external to a social system "who influences clients' innovation decisions in a direction deemed desirable by a change agency" (p. 366). The term change agent has made its way into the popular vernacular and, in some cases, has lost it original, intended meaning. However, as used in relation to the adoption of innovations, change agents employing strategies that emphasize supportive and persuasive interaction and communication with clients are most likely to increase innovativeness in clients (Foster, 1968; Purdy, 1968; E. M. Rogers, 2003). It is suggested that the field of diffusion studies would be well-served to follow the line of inquiry of those interested in overt behavior change by exploring the role of self-efficacy and motivation, as this research may reveal additional strategies or areas of focus for change agents.

Models for diffusion of innovations in higher education have been developed in response to a number of trepidations regarding global models, including concerns about the generalizability of diffusion results from other fields (Hall et al., 1973), the complexity of change in education (Zaltman et al., 1977), the failure rate of innovations in education (see Bolman & Deal, 1999; Borins, 2001), and the considerable number of innovations introduced within this context (Zaltman et al., 1977). Havelock (1971) presents an excellent starting point for considering diffusion models in higher education as he summarizes three general types of diffusion models and offers his Linkage Model, which synthesizes pre-existing research and theory. Havelock's work heavily influenced the Concerns-based Adoption Model (CBAM), which requires a facilitator or change agent who stages appropriate interventions in response to adopter concerns (Hall et al., 1973). Holloway (1996) frames the diffusion process in higher education in business

terms where adoption is driven by rewards; however, unlike business models, rewards in higher education typically come in the form of status, reputation, feeling modern, and personal satisfaction. Reigeluth and Garfinkle (1994) views the diffusion process from a systemic standpoint, where the adoption of an innovation can have unintended ripple effects that may impact those who are perceived to be beyond the social system.

Other theorists in education offer partial models that focus on particular aspects of the diffusion process. Zaltman et al. (1977) offer five factors that result in barriers to innovation adoption. Ely (1990) offers eight adopter and environmental conditions that support change efforts in higher education. Fullan (2001) identifies eight factors that influence adopters' progress toward adoption. As might be expected, Ely's conditions and Fullan's factors act as counter points to the barriers outlined by Zaltman et al. As an example, Ely and Fullan state that rewards facilitate the adoption process while Zaltman et al. say that the lack of rewards acts as a barrier. Interestingly, all of these models provide means for collecting diagnostic information regarding the innovation, adopters and/or the social system, and this information is then available to inform interventions. Within higher education, faculty development is often a conduit through which diagnostic information is collected, interventions are delivered, and aspects of the change process are managed and facilitated (Chait & Gueths, 1981).

Currently, faculty development is responding to a number of challenges including those posed by evolving cognitive learning theories, emerging instructional technologies, and educational reform. Faculty development literature offers six broad strategies that are being employed to ensure the longevity of programs and increase the likelihood that faculty will participate, learn, and ultimately change. These faculty development best

practices include the management of institutional issues, implementation of adult learning practices, offering of incentives to participate, delivery of workshops, utilizing colleagues and peers, and ongoing support.

While a majority of institutions in the United States are funding faculty development programs, "there is a paucity of experimental research on the effects of teaching-improvement interventions" (Wilkerson & Irby, 1998, p. 390). In addition, the quality of the methodologies that have been employed have not been considered rigorous (Levinson-Rose & Menges, 1981; Weimer & Lenze, 1991). In an attempt to better organize and legitimize research practices for measuring the success of faculty development programs, Stratos et al. (2004) posit a research agenda for faculty development concerned with four areas: context, topics, participants, and process. Process may be of the greatest interest as it addresses the impact of the practices employed by faculty development centers. The majority of the research that has explored faculty development practices employs quasi-experimental or qualitative research methods. These methods will likely continue to be prevalent.

While the literature concerning faculty development seldom makes an overt connection to change agent concepts, the theoretical parallel is clear. An internal change agent, as defined by Rogers (2003), is exemplified by the way faculty development is situated within higher education and by the goals and practices of those programs. By recognizing and embracing this connection, additional frameworks through which to view faculty development practices and conceptualize future areas of study begin to emerge.

It follows, then, that a line of inquiry that considers the underlying psychological processes that are affected by faculty development practices, within the context of Rogers' view of the adoption of innovations, would be a timely endeavor. It would serve to provide direction and a foundation for future experimental examinations of specific faculty development practices and processes, as recommended by Stratos et al. (2004). It would also incorporate an additional, relevant body of knowledge (i.e., diffusion studies) through which to view faculty development. What follows, then, is an extension of aspects of studies from the health-related change body of literature (e.g., DiClemente et al., 1991; Galavotti et al., 1995; Marcus et al., 1992; Prochaska & DiClemente, 1983), revised for the context of higher education and faculty development, using frameworks provided by change agent and diffusion literature. Specifically, the research questions under consideration by this research are as follows:

Research Questions

1. Are college teaching, teaching with technology, and general self-efficacy scores for college teachers the same regardless of sex, age, years of experience, professional rank, highest degree held, discipline, college, class size, self-assessment of computer skills, computer type preference, or number or type of institutionally-sponsored faculty development experiences?
2. What are the relationships between the number and type of faculty development experiences and college teaching self-efficacy?
3. What are the relationships between the number and type of faculty development experiences and teaching with technology self-efficacy?

4. Do faculty development experiences predict college teaching self-efficacy or teaching with technology self-efficacy?
5. What are the relationships between general self-efficacy, college teaching self-efficacy, teaching with technology self-efficacy, and instructional technology-based innovation-decision stage for faculty in higher education? Do self-efficacy scores predict innovation-decision process stage for those in the process of adopting instructional technologies? Is this true regardless of demographic variables?

Chapter 3: Methodology

Research Method

Self-efficacy is a judgment an individual has regarding his/her personal capability to be successful on a future task, and it varies depending upon the task under consideration (Bandura, 1997). When evaluating research methodologies, then, observational methods would prove to be an ineffective way to measure personal judgment, as observation favors the study of overt behaviors. When measuring attitudes, beliefs, and past or intended future behaviors, survey methodologies are most effective. They are also an effective means to capture facts and demographic data (Cozby, 2007). Given this context, previous influential studies on self-efficacy in educational settings have used surveys as the research method of choice (e.g., Bandura, 2006; Benz, Bradley, Alderman, & Flowers, 1992; Enochs, Riggs, & Ellis, 1993; Gibson & Dembo, 1984; Pajares & Miller, 1994). The self-efficacy study described here is a descriptive study in general and correlational study specifically; considering the educational context of this self-efficacy study, along with the types of data needed to address the aforementioned research questions, a survey methodology was employed.

Population Profile and Setting

The target population for this study included all actively teaching faculty and actively teaching graduate students at a large, Research I, land grant university located in the mid-Atlantic region of the United States. The research took place during the spring of 2007 and only involved faculty and graduate students who were considered the "instructor of record" of one of more courses during the spring semester at this institution. Data obtained from this institution's Office of Institutional Research and

Table 1

Full-time Faculty Rank Percentages at Targeted Institution

Rank	Percentage
Professor	37.44
Associate Professor	29.98
Assistant Professor	18.53
Non-Tenure Track, Full-Time Instructional Faculty	14.04

Effectiveness provides a demographic picture of this university. As of October 2006, this university had over 21,500 undergraduate students and about 6,000 graduate students. Looking specifically at the target population for this study, there were 1,599 (tenured, tenure-track, and non-tenure track) full-time teaching faculty and 1,271 graduate students holding graduate teaching assistantship (GTA) positions at that time. Table 1 provides information regarding the rank of instructional faculty at this university. Sex demographic information for full-time instructional faculty can be found in Table 2. Sex data regarding GTAs was unavailable; however, when considering the entirety of the graduate student population, men comprise 62.4 percent and women comprise 37.6 percent. These figures include GTAs and non-GTAs.

It should be noted that the total teaching population is not a sum total of full-time teaching faculty and GTA populations. Certainly some faculty were on sabbatical and many GTAs do not actually teach courses; rather, their role is often that of "grader" within a course led by a teaching faculty member. Additionally, this institution has A/P (Administrative / Professional) faculty and part-time adjuncts who often teach courses,

Table 2

Sex of Those Teaching at Targeted Institution

Rank	Men	Women
Professor	86.82%	13.18%
Associate Professor	71.94%	28.06%
Assistant Professor	61.43%	38.57%
Non-Tenure Track, Full-Time Instructional Faculty	47.51%	52.49%
Overall Averages	72.17%	27.83%

which further complicates the picture of arriving at accurate teaching population statistics; however, these teaching population estimates and the data provided in Tables 1 and 2 provide useful information when determining if the total respondents are representative of the actual population of this institution.

Additional characteristics of this institution that are pertinent to this study are its approaches to development for instructional faculty and GTAs. The institution supports two agencies that are responsible for this personnel development mission: one is a traditional teaching and learning center (TLC) and the other center focuses on applications of technology for teaching and research (TTR). For GTAs, in addition to the availability of TLC and TTR offerings, a graduate student teaching preparation program (GSTP) provides graduate courses intended to prepare GTAs for teaching. Additionally, the School of Education offers a college teaching course and many departments and colleges offer discipline-specific GTA preparation courses.

The TLC, TTR, and GSTP centers are positioned as change agents, consistent with the second view of change agents described earlier (e.g., Anderson & Anderson, 2001; Dormant, 1986; Duck, 1998; Keil, 1969; Weiss, 2003). Specifically, they are situated internally, rather than externally, to the institution and have a clear understanding of the institution's mission. Such positioning ensures that these units can capitalize on their familiarity with the university's social norms and that they are capable of having ongoing relationships with adopters.

The TLC at this institution is located in the provost's office and focuses specifically on pedagogy. Topics regarding applications of technology are not typical of its curriculum or mission. The TTR center is situated within the academic computing arm of the central information technology group and provides computer training as it relates to teaching and learning as well as research. Basic computing skills, such as PowerPoint and web development are also taught by this agency. The GSTP, like the TTR center, is part of academic computing; however, its offerings are listed as for-credit courses via this institution's graduate school. The TLC and TTR center have incentive campaigns to encourage participation and foster instructional transformation. The former offers stipends for participation in some of its programming in addition to grant support for course revitalization, curricular change, etc. The latter is the institutional mechanism through which faculty receive new computers and, as a result, enjoys extremely high faculty attendance rates during its summer institutes. The TTR center offers academic year workshops as well, which typically are not incentive-based. Courses offered by the GSTP program do not include incentives, other than course credit, for graduate students.

Procedures

Regarding sampling methodology, a sample was not taken. Rather, the survey instrument was sent to everyone at this institution who was teaching a course during the spring semester 2007. A definitive list of these "instructors of record" was obtained in the following fashion: Each semester, the unit within this university that manages its enterprise-level course management system creates empty, web-based course "shells" for every course that is scheduled. To do this, the unit receives a complete list of courses, instructors, and instructor e-mail addresses from the registrar. This unit's director provided the researcher with these instructor e-mail addresses. Thus, the researcher had a comprehensive list of "instructors of record" for the spring semester 2007. The total number of faculty and graduate students on that list was 1,856; however, as the study began, the e-mail server returned messages concerning eight e-mail addresses with statements indicating that they were "undeliverable." This may have been due to inaccurate forwarding by the institution's e-mail server. Additionally, five of those who received the message e-mailed the researcher directly to state that they were, in fact, not teaching during that semester and would not be participating in the study. As a result, the total number of faculty and graduate students who were capable of participating in this study was 1,843.

Institutional Review Board approval for this study was received on February 13, 2007 (Appendix A), and data collection began that same day. Via e-mail, an invitation to participate in the study was sent to everyone named on the list described above (Appendix B). On February 21, a reminder e-mail was also sent (Appendix C). Early on

February 27, a final reminder was sent via e-mail (Appendix D). A date of February 28, 2007 was listed as the end of data collection in all of these e-mail messages.

All three e-mail messages contained a web link to an online informed consent form, which acted as a gateway into the survey; the consent form and the survey were housed on separate servers, and participants were not asked to provide any identifying information during the informed consent process. The anonymous consent form (Appendix E) offers a description of the risks involved to participants as well as an overview of the research. To consent, participants were asked to read the consent form and then click a "Provide Consent" button. Upon submitting, the consent form was sent to the researcher electronically with a time and date stamp. Participants were then taken to the survey instrument.

It should be noted that because all data was self-reported, faith has been placed in the accuracy of the responses received from study participants. Because the survey was anonymous, there were not opportunities to verify the responses received. This lack of verification is likely most concerning in regard to questions that required faculty to recall and report upon their faculty development experiences over the past three years. Reporting this type of experience is inherently more difficult than reporting upon demographic information, such as sex, faculty rank, etc., and it is posited that the probability of reporting errors are greater in those specific areas.

Instrument

The survey instrument (Appendix F) used to address the aforementioned research questions consisted of five parts: a series of demographic questions, a college teaching self-efficacy scale, a teaching with technology self-efficacy scale, a general self-efficacy

scale, and an innovation-decision process indicator where instructional technologies are the innovation under consideration.

Part One – Demographic Information

The survey instrument began with a series of questions designed by the researcher. These questions were crafted to collect demographic information including sex, age, years of teaching experience, professional rank, class size, highest degree held, discipline, college, self-assessment of computer skills, computer type preference, and the number and type of institutionally sponsored faculty development experiences designed to improve teaching in which the respondent has participated.

Part Two – College Teaching Self-Efficacy Scale (CTSES)

While the literature provides several examples of teaching self-efficacy instruments, the vast majority are intended for those in secondary education rather than higher education (e.g., Ashton, 1984; Ashton, Olenjnik, Crocker, & McAuliffe, 1982, March; Benz et al., 1992; Gibson & Dembo, 1984; R. K. Henson, Kogan, & Vacha-Haase, 2001). Because of this specificity, many of the existing instruments seek data with a focus on interactions with principals, parents, student home life, gang violence, and other concerns that are unique to that particular educational context. From a self-efficacy instrument construction perspective, such a focus is appropriate for a secondary education audience since "scales of perceived self-efficacy must be tailored to the particular domain of functioning that is the object of interest" (Bandura, 2006, pp. 307-308); this focus would not, however, be considered relevant for an audience in higher education. This is not to say that an interest in teaching self-efficacy has been completely lacking in higher education; however, following Bandura's advice, most teaching self-

efficacy instruments created for higher education are discipline-specific and most are designed for the areas of science, mathematics and medicine and reference content-specific issues (Enochs et al., 1993; Germann & Sasse, 1997; Lichty, 2000; Sommers, Muller, & Ozer, 2000).

In light of the need for a credible instrument for measuring college teaching self-efficacy, Leonor Prieto Navarro at Universidad Pontificia Comillas developed the College Teaching Self-Efficacy Scale (CTSES) in 2005. For her efforts in the development of the CTSES, the author won "the prize for pedagogical research at the 19th Edition of the awards given by the Ministry of Education and Science and the General Council of Doctors and Graduates in Arts and Sciences" in Madrid, Spain (Alaminos, 2006, March). An English translation of this instrument has been posted on Frank Pajares' comprehensive self-efficacy web site at Emory University where he describes it as a "sound scale that can be trusted" (Pajares, 2006). In addition to Dr. Pajares' endorsement, the research supporting this instrument reports that it has a reliability co-efficient of 0.94 (Prieto, 2005). The researcher contacted Dr. Prieto, and she provided her permission to use this instrument for this study (see Appendices G and H).

The response scale of the CTSES offered a range of one to six; however, Bandura observes that those scales which "use only a few steps should be avoided because they are less sensitive and less reliable" (2006, p. 312). He notes that people tend to avoid the extremes on scales, and as a result, the response range is actually smaller than six steps. Research specifically comparing the merits of a more traditional six-step Lickert scale to a longer scale found that the longer scale was psychometrically stronger (Pajares,

Hartley, & Valiante, 2001). This research provides empirical evidence supporting Bandura's recommendation specifically in regards to the increased reliability of longer scales in self-efficacy studies. Informed by these observations, Bandura recommends using a 0-to-10 or a 0-to-100 range for self-efficacy scales (Bandura, 2006). Given that those in higher education are already using a 100 point scale to grade student work, the researcher had concerns that using a 0 to 100 scale for this instrument might result in higher than normal reporting of self-efficacy. Below 60 is seen as failure in this context and might be avoided by those within this population. As a result, the researcher adopted a 0-to-10 response scale for use with the CTSES.

Part Three: Teaching with Technology Self-Efficacy Scale

As with teaching self-efficacy scales, the literature provides a number of teaching with technology self-efficacy scales. Again, most are either for secondary education or are discipline specific within higher education (e.g., Delcourt & Kinzie, 1993; Enochs et al., 1993; Germann & Sasse, 1997; Kennedy, 1992; Lichty, 2000). Other studies measure general faculty computer self-efficacy without making a specific connection to the task of teaching (e.g., Dusick, 1998; Faseyitan et al., 1996; Murphy, Coover, & Owen, 1988, April). At this time, the literature shows that a general college teaching with technology self-efficacy scale has not been created; however, it does provide guidance for the selection of an appropriate measure of this construct.

Informed by the model offered by Gibson and Dembo's (1984) influential teacher self-efficacy scale for secondary education, Riggs and Enochs (1990) developed an instrument to measure the self-efficacy of science teachers. From that beginning, Enochs, Riggs, and Ellis (1993) developed the *Microcomputer Utilization in Teaching*

Efficacy Beliefs Instrument (MUTEBI) containing two subscales, one of which was a teaching with technology self-efficacy scale containing ten questions. The self-efficacy scale had a reliability of 0.91 (n=232). Although the intended audience for the study consisted wholly of science teachers, the questions were worded in non-discipline specific terms and could be reasonably ported to other disciplines. In a study of faculty teaching first year medical courses, Lichty (2000) did just that. Although her sample size was somewhat small (n=98), she reported receiving an internal consistency (Cronbach's alpha) of .80. The researcher elected to use Lichty's version of the MUTEBI to determine teaching with technology self-efficacy, given that the instrument has been used on different populations; its lineage includes the highly respected Gibson and Dembo scale; and it is generally accepted that an instrument with a coefficient of .90 or higher is very reliable and one falling within the range of 0.70 to 0.90 is acceptable (McMillan & Schumacher, 2001).

Both Enochs, Riggs, and Ellis (1993) and Lichty (2000) used a five point Likert response scale. Following the findings of Pajares, Hartley, and Valiante (2001), the advice of Bandura (2006), and based upon the argument provided earlier regarding the selection of appropriate response scales for self-efficacy studies, the researcher modified the response scale for this portion of the instrument to an eleven step, 0-to-10 scale.

Part Four: New General Self-efficacy (NGSE) Scale

While most researchers have followed Bandura's (1997) guidance by "studying self-efficacy as a task-specific or state-like construct" (Chen, Gully, & Eden, 2001, p. 63), there is another school of thought concerning self-efficacy that posits individuals also have task-independent self-efficacy (Scherbaum, Cohen-Charash, & Kern, 2006).

This type of self-efficacy is termed *general* self-efficacy. General self-efficacy is defined as "individuals' perception of their ability to perform across a variety of situations" (Judge, Erez, & Bono, 1998, p. 170). The difference between the two has been summarized by stating that task-specific self-efficacy "is a motivational state and general self-efficacy is a motivational trait" (Chen et al., 2001, p. 63). It is argued that both general self-efficacy and task-specific self-efficacy contribute to an understanding of motivation and behavior (Eden, 1988). Thus, to broaden the understanding of faculty self-efficacy, the researcher elected to include a general self-efficacy scale within the larger instrument.

Three respected general self-efficacy scales emerge from a review of the literature: the General Self-efficacy Scale (M. Sherer et al., 1982), the General Perceived Self-efficacy Scale (Schwarzer & Jerusalem, 1995), and the New General Self-efficacy Scale (Chen et al., 2001). M. Sherer et al.'s scale has been widely used, however, the psychometric evidence supporting it has not always been encouraging of its use (Chen et al., 2001). Schwarzer and Jerusalem's scale has been widely employed outside of the United States and has been translated into 29 languages (Schwarzer, 2005, April 5). Taking a sample of its application from a number of countries, it was found that the internal consistency of this instrument ranged from 0.75 to 0.91 (Scholz, Gutierrez-Doza, Sud, & Schwarzer, 2002).

Chen et al.'s New General Self-efficacy Scale (2001) is the most recently constructed of the three, and the initial reviews have been positive. In studies where it has been used, the internal consistency (alpha coefficient) has been found to fall in the 0.85 to 0.90 range (Scherbaum et al., 2006). Scherbaum et al. (2006) recently compared

these three instruments using item response theory. "The results indicated that the New General Self-efficacy Scale has a slight advantage over the other measures... in terms of the item discrimination, item information and relative efficiency of the test information function" (Scherbaum et al., 2006). Given the consistently strong alpha coefficients and the results of the comparison, the New General Self-efficacy Scale was selected as the general self-efficacy scale for this study. The researcher has contacted Dr. Chen, the creator of this instrument, and he has provided his permission to use this instrument for this study (see Appendix I).

Again, following the findings of Pajares, Hartley, and Valiante (2001), the advice of Bandura (2006), and based upon the argument provided earlier regarding the selection of appropriate response scales for self-efficacy studies, the researcher modified the response scale for this portion of the instrument to an eleven step, 0-to-10 scale.

Part Five: Innovation-Decision Process Indicator

Lichty (2000) developed the Innovation-Decision Process Indicator (IDPI) as an instrument to place medical school faculty in one of Rogers' (2003) five innovation-decision stages regarding the adoption of instructional technologies. The instrument requires that faculty check all of the statements regarding adoption that apply to them. The total number of statements checked is then determined, and based upon this number, participants are placed into one of the five innovation-decision stages. To aid in instrument validation, Lichty (2000) arranged a small pilot consisting of five faculty. Due to the results of the pilot, faculty feedback, and an item analysis, the instrument, originally consisting of 25 statements, was reduced to 15. In its final form, it contains three statements corresponding to each of the five innovation-decision stages.

Partial validation of this instrument was also a goal of Lichty's study. In addition to completing the IDPI, faculty were given a complimentary instrument in which they were to read a summary of Rogers' (2003) theory and self-assign themselves into one of the five innovation-decision stages. Sixty-nine participants filled out both of these sections. The results of an ANOVA showed that no significant difference was found between the instruments. Further, the reliability for the IDPI was found to be 0.84. Gable and Wolf (1993) recommend a reliability of 0.80 or higher for scales within the affective domain. Given the reasonable Cronbach alpha, the rigors used in creating this instrument, and its development for a teaching audience in higher education, the researcher has selected the IDPI for inclusion within this study. The researcher has also contacted Dr. Lichty who has provided her permission for the use of her instrument for this study (see Appendix J).

Pilot Study

A total of ten faculty members from the target population participated in pilot activities. A pre-pilot activity was held prior to the official pilot with one member of the target population. The purpose of this pre-event was to catch glaring grammatical or typographical errors and to determine a reasonable procedural time estimate for inclusion in the invitation e-mail message prior to the pilot (see Appendix B).

The pilot study was held on January 8, 2007, with committee permission, in a computer lab with nine faculty from the target population. These nine faculty represented seven different university departments. The purpose of this pilot was to collect data that would enable the researcher to correct any confusion regarding the procedure, the instructions, and/or the wording of the questions.

The pilot procedure consisted of three stages. The first stage replicated the procedures of the planned study. Each pilot participant was sent the invitation letter (see Appendix B) via e-mail. Participants were asked to check their e-mail, and the start time was recorded. Participants were then asked to follow the directions provided in the invitation e-mail, and after submitting the informed consent form (see Appendix E), were instructed to raise their hand with one finger extended to signify that they had completed that form and were beginning to respond to the instrument. The time at this point was noted for each participant. After completing and submitting the instrument, participants raised their hand a second time with two fingers extended. This time was also recorded, and, via this method, the length of time it took to complete the instrument was determined. Completion of the consent form took between two and six minutes for these participants, and completion of the instrument took between six and fourteen minutes. It was determined that the two participants at the top of the latter time range had been taking notes to provide the researcher with feedback. As a result, a time estimate of 10 to 15 minutes was determined for inclusion in the invitation e-mail and the informed consent form.

As each participant raised his/her hand to signify completion of the instrument, he/she entered the second stage of the pilot. As a result, each participant entered this stage at different points in time. In the second stage, participants received a paper-based copy of the informed consent form and the instrument and were asked to make notes and offer feedback regarding places where confusion may have arisen. Other areas of feedback, such as typographic, grammatical, and procedural, were also encouraged. No areas of feedback were discouraged.

After each participant had several minutes to provide written feedback, stage three began. An open-ended, group dialogue was facilitated, which enabled participants to respond to the perceptions of their peers in the pilot. At this time, pilot participants were free to ask about the goals of this research as well as the methodology employed.

The most significant results of the pilot were that the procedures and the technologies employed for this study were appropriate and functioned as expected. The majority of the feedback received from participants centered upon language they found unclear. For instance, some of the participants were uncertain of the terms "formative assessment," "systematic methods," and "computer-based instruction." Word choice changes were made to the instrument and additional text was added to address these concerns. Further, a variety of suggestions regarding ways to improve the flow of the prose in the invitation e-mail, informed consent form, and survey instrument instructions were offered. This advice has also been incorporated into the final version of each document.

It was also recommended that an additional demographic question be added to capture the number of students typically taught by a respondent. Participants in the pilot believed that college teaching self-efficacy could be impacted by class size. The recommendation to change the response range for years of teaching experience to provide granularity for older faculty as well as a request for greater clarity regarding faculty development experiences in the demographic questions were offered by the pilot participants. Further, several questions in part three of the instrument were originally phrased negatively, such as "I would not invite anyone to evaluate my computer-based instruction." There was strong sentiment from the majority of the pilot participants that

the negatively phrased questions made them feel defensive and should be reworded in a positive fashion. All of these recommendations were incorporated into the final version of the instrument (Appendix F).

Data Analysis

In addition to descriptive statistics stratified by the demographic variables, a chi-square goodness of fit test was used to determine how well the final respondent pool matched the sex and rank data obtained from this institution's Office of Institutional Research and Effectiveness (see Tables 1 and 2). Then, analysis of variance, Pearson's *r* and regression were used. Specifically, the following data analysis strategies were employed to address each of the five research questions.

Regarding the first research question, which considers college teaching self-efficacy, teaching with technology self-efficacy, and general self-efficacy in light of demographic variables, analysis of variance was used. ANOVA "tests for the presence of some overall significance that could exist somewhere among the various levels of the independent variables" (C. J. Goodwin, 2005, p. 234). If some overall significance was found for one or more of the independent (i.e., demographic) variables that possesses three or more levels, Tukey's post hoc test was used to determine the exact location of the significant difference.

To address the second and third research questions regarding the number and type of faculty development experiences and their relationship to self-efficacy, Pearson's *r* was used to determine if correlations did indeed exist between pairs of these variables. For pairs where correlations did exist, simple regressions were to be used to analyze all respondents. Had correlations been found, the variables would have been analyzed in the

following fashion: Faculty development with a sole focus on teaching (i.e., TLC) would have been treated as the predictor while college teaching self-efficacy and then teaching with technology self-efficacy would have been treated as criterion variables. Then, teaching with technology faculty development (i.e., TTR center) would have been treated as the predictor, while college teaching self-efficacy and then teaching with technology self-efficacy would have been treated as criterion variables. Since departmental GTA preparation workshops / graduate courses on teaching are typically taken only by graduate students, the GTA sub-population was then isolated to determine if significant correlations existed between the number of attendances in these GTA training opportunities and both types of self-efficacy. If significances had been found, simple regressions would have been implemented. GTA training courses would have been treated as the predictor, while college teaching self-efficacy and then teaching with technology self-efficacy would have been treated as criterion variables.

To examine the fourth research question concerning the predictive nature of faculty development experiences in relation to both types of self-efficacy, two separate multiple regressions were employed. The first viewed college teaching self-efficacy as the criterion variable, while two types of faculty development (TLC and TTR) were treated as predictor variables. Then, teaching with technology self-efficacy was treated as the criterion variable. Here, two types of faculty development (TLC and TTR) were again treated as predictor variables. Two additional multiple regressions were run to consider the GTA sub-population. In this case, all three types of faculty development (TLC, TTR and GTA preparation / courses on teaching) were treated as predictor

variables. The criterion variables were college teaching self-efficacy and then teaching with technology self-efficacy.

Regarding the fifth research question concerning the relationships between college teaching self-efficacy, teaching with technology self-efficacy, general self-efficacy, and instructional technology-based innovation-decision stage as it relates to the adoption of instructional technologies, ANOVA was employed first. The purpose was to determine if college teaching self-efficacy is significantly different across instructional technology-based innovation-decision stages. Where significant differences were discovered, Tukey's post hoc test was used to determine between which stages differences resided. These procedures were repeated with the pairing of teaching with technology self-efficacy and instructional technology-based innovation-decision stage and then again with general self-efficacy and instructional technology-based innovation-decision stage.

Simple regression was used to examine the relationship between college teaching self-efficacy and instructional technology-based innovation decision stage. It was also used to examine the relationship between teaching with technology self-efficacy and instructional technology-based innovation-decision stage as well as general self-efficacy and instructional technology-based innovation-decision stage. Multiple regression was used to examine the relationship that all self-efficacy types collectively have on the instructional technology-based innovation-decision stage. In these cases, college teaching self-efficacy, teaching with technology self-efficacy, and general self-efficacy were treated as predictor variables, while instructional technology-based innovation-decision stage was treated as the criterion variable.

Simple regression was also used to determine the relationship between self-efficacy types. Here, college teaching self-efficacy was treated as the predictor while teaching with technology was treated as the criterion. Two simple regressions were also used where general self-efficacy was treated as the predictor and college teaching self-efficacy, and then teaching with technology self-efficacy, were treated as criterion variables. To determine if these correlations were true for each demographic, the data set was divided into sub-populations based upon the levels within a given demographic variable, and this same set of tests were run for each sub-group.

Chapter 4: Results and Discussion

Overview of Data Collected

The survey instrument was available for data collection for approximately fifteen days. Of the 1,843 possible respondents, 394 submitted the survey instrument resulting in a response rate of 21.4 percent. All 394 submissions contained data; however, some respondents chose not to provide answers to some questions. The resulting scores for the three self-efficacy scales are composite scores where an average was taken of all the responses for each of those three scales. For the College Teaching Self-efficacy Scale (CTSES), 391 of the submissions provided enough data to arrive at an average score for those respondents. For the Teaching with Technology Self-efficacy Scale, 387 of the submissions provided enough data to arrive at an average score, and for the New General Self-efficacy Scale, 388 submissions resulted in a usable average as well. The Innovation-Decision Process Indicator resulted in 390 usable responses. Also of note is that 19 respondents chose not to report their department; however, all chose to report their college. It is theorized that some participants may have felt that by reporting their age, sex, and department, their anonymity would have been compromised. A summary of response rates per question area can be found in Table K1.

Sex and Age

Responses to the question regarding sex revealed that men accounted for 55.9 percent of the responses. Women comprised 44.1 percent of the responses. There were six options from which to select within the question regarding age. Approximately 75 percent of the responses were nearly evenly distributed over the ranges 30 to 39, 40 to 49, and 50 to 59. Table K2 offers an overview of these distributions.

Degree and Rank

Over 71 percent of the respondents hold a doctorate degree and approximately 24 percent hold a masters degree. Of the remaining respondents, the highest degree held was either a bachelors degree (4 percent), a juris doctor degree, or an educational specialist degree. Regarding professional rank, the highest response rate came from associate professors and full professors (both at 23.2 percent). Assistant professors comprise the second highest respondent group at 17.3 percent followed by full-time, non-tenure track instructional faculty (13.5 percent). A complete accounting of respondents' professional rank can be found in Table K3.

Teaching Experience and Class Size

Participants were also asked to report the number of years they have been teaching as well as the size of the classes they typically teach. Years of teaching experience was fairly evenly distributed across the range of options provided to respondents. The largest number (15 percent) reported having taught for six to ten years. The smallest number (6.3 percent) reported having taught for 26 to 30 years. The percentages for all remaining ranges fell between 6.3 and 15 percent (see Table K4).

Regarding the number of students typically taught in a single course, very few, 7.1 percent, reported teaching only large classes (those with more than 100 students), and of that 7.1 percent, only 2.3 percent reported typically teaching classes with over 200 students in them. The largest percentage (35 percent) reported teaching classes with between 25 and 50 students in them. Only slightly less were those who reported typically teaching courses with fewer than 25 students (29.9 percent). Just over 12 percent reported typically teaching classes with between 51 and 100 students. It should also be

noted that a significant percentage (15.7 percent) reported typically teaching courses both large and small.

Department and College

Respondents were asked to state the department in which they most often taught. Out of 375 responses, 87 different departments were represented. The highest percentage came from the English department (n=28, 7.1 percent). The departments of Biology (n=15, 3.8 percent), Teaching and Learning (n=15, 3.8 percent), Chemistry (n=14, 3.6 percent), Electrical and Computing Engineering (n=14, 3.6 percent), Mathematics (n=13, 3.3 percent), Psychology (n=13, 3.3 percent), and Human Development (n=10, 2.5 percent) had ten or more faculty members / GTAs participate in this study. Nine or fewer respondents represented each of the other departments. Three or fewer respondents represented most departments.

In addition to their department, respondents were asked to report in which college they most often teach. Over one-third reported teaching in the College of Liberal Arts and Human Sciences. This is more than double the representation of any other college (see Table K5).

Computer Skills and Preference

Two questions concerning computer skills and computer preference were included in the survey instrument. Respondents were asked to rate their own computer skills on a five-step range from novice to expert. All participants answered this question, and none self-assessed themselves as being a novice. Only 2.5 percent rated themselves as being below average. Nearly one-third (32 percent) described themselves as average,

but nearly half (48.5 percent) rated themselves as being above average. Almost one in five (17 percent) rated their computer skills as expert.

When asked to report what kind of computer they preferred, 61.2 percent of respondents selected Windows. Approximately one-third (33.2 percent) selected Macintosh. Nine participants, accounting for 2.3 percent, selected Linux. Eight more selected "Other" and described themselves as either not having a preference or preferring to use different types of computers for different types of tasks.

Faculty Development Experiences

Participants were asked to state the number of institutionally sponsored faculty development experiences in which they had participated. They were also asked to identify workshops on GTA preparation / graduate courses on teaching they had taken at this institution. A summary of these responses can be found in Tables K6 and K7 with stratifications based upon type of faculty development experience. The TTR center numbers reflect participation during academic year workshops rather than the summer as academic year TTR participation was the focus of data collection for this research.

It should be noted that while the mean is exceptionally low for GTA preparation / graduate courses on teaching for the entirety of the responding population, when considering the GTA sub-population, 33 out of 34 had taken or attended at least one of these courses. This subpopulation has attended, on average, 1.647 graduate courses or departmentally sponsored GTA training sessions on teaching and learning.

Description of Self-efficacy Scales Responses

For each of the three self-efficacy scales, the responses were averaged to determine three overall scores. The College Teaching Self-efficacy Scale is comprised of

44 questions. Responses that contained three or fewer missing values to this scale were kept and included in this study. The Teaching with Technology Self-efficacy Scale contains ten questions. Responses that had one or fewer missing values were included in this study. The New General Self-efficacy Scale contains eight questions, and responses with one or fewer missing values were kept as well. A summary of responses, overall means, and standard deviations can be found in Table K8.

Description of Innovation-Decision Process Indicator Responses

The total number of responses for this scale ranged from zero to 15 with 15 being the highest possible. Based upon groupings of total numbers of responses, respondents were placed into one of five instructional technology-based innovation-decision stages. Those who checked between zero and three statements were placed into the knowledge stage. Those who checked between four and six statements were placed into the persuasion stage; between seven and nine were placed into the decision stage; between 10 and 12 were placed in the implementation stage; and between 13 and 15 were placed in the confirmation stage. With 390 valid responses, the mean response following placement into one of the five stages was 2.515 (persuasion stage). The standard deviation was 1.103. A summary of instructional technology-based innovation-decision process responses can be found in Table K9.

Goodness of Fit

To determine how representative respondents were of the larger teaching population at this institution, chi-square goodness of fit tests were employed. Using data obtained from this institution's Office of Institutional Research and Assessment (see Tables 1 and 2), expected numbers of responses were determined for the sub-population

Table 3

Faculty Rank and Sex with Expected Frequencies

Rank	Men	Women	Total
Professor	70(98)	21(15)	91(113)
Associate Professor	53(65)	36(25)	89(90)
Assistant Professor	36(34)	31(21)	67(55)
Non-Tenure Track Instructional Faculty	25(20)	28(22)	53(42)
Total	184(217)	116(83)	300(300)

Note. Expected frequencies are in parentheses.

of full-time teaching instructors and professors who also reported their sex. Unfortunately, this institutional data source was not complex enough to enable a determination of expected frequencies for the entirety of the institution's teaching population; thus, only this sub-population, comprising 76 percent of the complete responding population, is considered here.

There were 300 faculty in the response pool that provided both faculty rank and sex information and were either professors or full-time instructors (see Table K3). The data in Table 3 shows the expected and observed responses for this sub-population stratified by sex. The resulting chi-square value is 25.22 with three degrees of freedom. The critical value at the 0.05 level with $df = 3$ is 7.82. Since the calculated chi-square value exceeds this value, the researcher has concluded that this sub-population of respondents is not representative of the larger population of professors and full-time instructors at this institution.

Sex information for the graduate student population was also available from this institution's Office of Institutional Research and Assessment. It states that 62.4 percent are men and 37.6 percent are women. Only 34 of the respondents were graduate students, accounting for 11 percent of the responding population. Thirty-three provided their sex, and women (76 percent) respondents far exceeded men (24 percent). Considering the goodness of fit for this sub-population, it was found that the GTA sub-population of respondents did not accurately reflect the larger graduate student population (chi-square value of 22.13, $df = 1$) either. In summary, it is concluded that the population of respondents for this study is not statistically representative of the larger population at this institution.

Analysis of Research Question One

The first research question concerns the three types of self-efficacy and their relationship to the demographic / professional experiences variables: "Are college teaching, teaching with technology, and general self-efficacy scores for college teachers the same regardless of sex, age, years of experience, professional rank, highest degree held, discipline, college, class size, self-assessment of computer skills, computer type preference, or number or type of institutionally sponsored faculty development experiences?"

Results

To explore this question, one-way analysis of variance (ANOVA) was used to determine if there were any significant differences between the means of each of the levels of the demographic / professional experiences variables.

Sex. When considering sex and college teaching self-efficacy, it was found that there were significant differences between men and women, $F(1,385) = 5.748$, $p < .05$. This was also true for general self-efficacy, $F(1, 382) = 4.699$, $p < .05$. In both cases, women have significantly higher self-efficacy than men. When considering sex and teaching with technology self-efficacy, significant differences were again found, $F(1, 381) = 6.935$, $p < .01$, but here, men have significantly higher self-efficacy than women. Table L1 provides the means and standard deviations for all three types of self-efficacy stratified by sex.

Age. Regarding age, no significant differences were found in teaching with technology self-efficacy between any of the groups, $F(5, 379) = 1.940$, $p > .05$. This was also the case for general self-efficacy, $F(5, 380) = 1.111$, $p > .05$; however, for college teaching self-efficacy, significant differences were found between groups, $F(5,383) = 3.510$, $p < .01$. Tukey's post hoc test revealed that the differences were between those in their twenties and those in their forties, fifties, and sixties. Those in their twenties had significantly lower college teaching self-efficacy. Table L2 provides the means and standard deviations for all three types of self-efficacy stratified by age.

Degree. It was found that there were no significant differences for college teaching, teaching with technology, or general self-efficacy based upon the degree held by respondents. A statistical summary and narrative regarding these findings can be found in Appendix M.

Rank. When considering faculty rank, it was found that there were no significant differences between any of the ranks in relation to teaching with technology self-efficacy, $F(7,365) = 1.116$, $p > .05$; significant differences were detected, however, for college

teaching self-efficacy, $F(7,369) = 2.489$, $p<.05$. Tukey's post hoc test revealed that the only differences were between full-time, non-tenure track instructors and assistant professors, as well as between full-time, non-tenure track instructors and doctoral-level GTAs. Instructors' college teaching self-efficacy was higher in both cases. A similar trend was found with regard to general self-efficacy, $F(7,366) = 2.619$, $p<.05$. Tukey's post hoc test showed that the only significant difference was between full-time, non-tenure track instructors and associate professors. Instructors, again, had significantly higher general self-efficacy. Table L4 provides the means and standard deviations for all three types of self-efficacy stratified by faculty rank.

Teaching Experience. Concerning the number of years respondents had taught on the college level, there were no significant differences between any of these groups with regard to teaching with technology self-efficacy $F(8,378) = 1.203$, $p>.05$, or general self-efficacy $F(8,379) = 0.646$, $p>.05$. A significant difference was found when considering college teaching self-efficacy, $F(8,382) = 2.223$, $p<.05$; however, Tukey's post hoc test did not reveal a location of any specific significance. Table L5 provides the means and standard deviations for all three types of self-efficacy stratified by years of teaching experience.

Class Size. It was found that there were no significant differences for college teaching, teaching with technology, or general self-efficacy based upon the size of classes taught by respondents. A statistical summary and narrative regarding these findings can be found in Appendix M.

Department. Because faculty and GTAs from 87 different departments responded to the survey, many departments are represented only once or twice. For the comparison

of self-efficacy means by departments, only departments that were represented five or more times were included in this analysis. Twenty-six departments (n=226) are considered. When considering college teaching self-efficacy, significant differences were found, $F(25, 201) = 2.028$, $p<.01$. Tukey's post hoc revealed that faculty and GTAs in English had significantly higher teaching self-efficacy than those in Chemistry and Electrical and Computer Engineering. Faculty in Foreign Languages and Literatures were also found to have higher teaching self-efficacy than those in Electrical and Computer Engineering. Regarding teaching with technology self-efficacy, significant differences between departments were not found, $F(25, 200) = 1.120$, $p>.05$. This was also true for general self-efficacy, $F(25, 200) = 1.155$, $p>.05$. Table L7 provides the means and standard deviations for all three types of self-efficacy stratified by department.

College. When considering the college to which respondents belong and college teaching self-efficacy, it was found that there were significant differences, $F(7,380) = 5.571$, $p< .01$. Tukey's post hoc test showed that faculty and GTAs in the College of Liberal Arts and Human Sciences had significantly higher teaching self-efficacy than those in Agriculture and Life Sciences, Engineering, Science, and Veterinary Medicine. This was not true for teaching with technology self-efficacy, as no significant differences between colleges were found along that dimension, $F(7, 376) = 1.513$, $p>. 05$. For general self-efficacy, no significant differences were found either, $F(7,377) = 0.935$, $p>.05$. Table L8 provides the means and standard deviations for all three types of self-efficacy stratified by college.

Computer Skills. The data indicated that college teaching self-efficacy did not vary significantly based upon one's own self-perception of computer competency,

$F(3,387) = 1.236$, $p>.05$. This was also true for general self-efficacy, $F(3,384) = 1.492$, $p>.05$. The opposite was found for teaching with technology self-efficacy, $F(3,383) = 72.868$, $p<.001$. Further, Tukey's post hoc test revealed that there were significant differences between all levels of self-perceived computer skills. Table L9 provides the means and standard deviations for all three types of self-efficacy stratified by computer skills.

Computer Preference. It was found that there were no significant differences for college teaching, teaching with technology, or general self-efficacy based upon the computer preference of respondents. A statistical summary and narrative regarding these findings can be found in Appendix M.

Faculty Development Experiences. It was found that there were no significant differences for college teaching, teaching with technology, or general self-efficacy based upon respondents attendance in any type of faculty development experience. A statistical summary and narrative regarding these findings can be found in Appendix M.

Discussion

What follows is a narrative summary of the significant findings regarding the demographic variables and the three types of self-efficacy as outlined above:

Most significance was found pertaining college teaching self-efficacy:

- Women were found to have significantly higher college teaching self-efficacy than men;
- Those in their forties, fifties, and sixties have significantly higher college teaching self-efficacy than those in their twenties;

- Full-time, non-tenure track instructors have significantly higher college teaching self-efficacy than doctoral-level GTAs and assistant professors;
- Faculty and GTAs in the department of English and Foreign Languages have significantly higher college teaching self-efficacy than those in Electrical and Computer Engineering. Those in English also have significantly higher self-efficacy than those in Chemistry; and
- Faculty in the College of Liberal Arts and Human Sciences have significantly higher college teaching self-efficacy than those in Agriculture and Life Sciences, Engineering, Science, and Veterinary Medicine.

Regarding teaching with technology self-efficacy, the following was found:

- Men have significantly higher teaching with technology self-efficacy than women; and
- Those who rate themselves as having higher computer skills also have significantly higher teaching with technology self-efficacy. This is true between all levels of computer skills.

In consideration of general self-efficacy, the following was found:

- Women have significantly higher general self-efficacy than man; and
- Full-time, non-tenure track instructors have significantly higher general self-efficacy than associate professors.

The findings confirm several presumptions that logic tells us would be true about college teaching self-efficacy. For instance, it is not surprising to find that those early in their career in higher education (in their twenties) have lower college teaching self-efficacy, than those who have more career and teaching experience. Also noteworthy,

although not unexpected, is the finding that full-time, non-tenure track instructors have the highest college teaching self-efficacy among the professional ranks, significantly higher than those either preparing for the professoriate or those currently engaged in the tenure process. At this institution, most full-time instructors teach four classes each semester during the academic year and do not have any publishing / research requirements or responsibilities. As professional teachers, they are charged with focusing solely on teaching and learning; doctoral students and assistant professors, however, must put enormous energy into research, writing, and publishing. Given this divergent career focus, it would be expected that instructors would have higher college teaching self-efficacy.

Also noteworthy is the confirmation that some faculty in the liberal arts, specifically English and Foreign Languages, have significantly higher college teaching self-efficacy than those in Electrical and Computing Engineering (English is also higher than Chemistry). Further, it was determined that faculty in the larger College of Liberal Arts and Human Sciences, which houses the School of Education as well as English and Foreign Languages, also has significantly higher college teaching self-efficacy than faculty in four of the remaining seven colleges. It may also be important to note that the colleges with the lowest college teaching self-efficacy are the ones that are assumed to carry the largest research burden. Following a similar argument regarding full-time, non-tenure track instructors, it is likely that diminishing faculty attention on teaching has occurred in those areas where research is more heavily emphasized and teaching success is arguably valued less.

Of the findings regarding college teaching self-efficacy and its relationship to the demographic variables, possibly the most interesting were the significant differences regarding sex ($F(1,385) = 5.748$, $p < .05$). Here, women were found to be significantly more efficacious than men. A review of the literature reveals that self-efficacy sex differences are found to be present in numerous places in our society. For example, when considering confidence in one's success in a career requiring quantitative skills, women have been found to have lower self-efficacy than men unless the specific skills are associated with tasks that have been historically perceived as feminine (Betz & Hackett, 1983; Junge & Dretzke, 1995). Within educational contexts, this has been explored as well. It was found that in elementary educational settings, men have higher science teaching self-efficacy (Riggs, 1991). With that said, little has been explored across disciplines in higher education regarding sex differences in college teaching self-efficacy.

A reasonable explanation for this sex difference may be found by considering the findings of Eccles (1989). Eccles, in longitudinal studies, found that parents play a role in perpetuating cultural stereotypes regarding women and mathematics. When daughters are in school, parents often attribute difficulties they have with math to their sex and frame math-related fields as being careers for men. This is true even though no significant sex differences were found in the math grades of these students. It's not surprising, then, that women have been found to have lower self-efficacy in quantitative careers (Betz & Hackett, 1983; Junge & Dretzke, 1995); however, teaching careers, especially on the secondary level, have traditionally been culturally stereotyped as careers for women. Might parents have played a role in perpetuating a stereotype of teaching as being feminine? More research is needed in this area; however, one might also speculate

that there may be sex-based differences in one's own conception of the career of professor. Might male professors identify more closely with the idea of themselves as a researcher rather than a teacher? Do female professors' self-conceptions differ in that they strongly identify with the part of their career that is involved with teaching? The existence of biases, rooted in early experiences, might contribute to the sex differences found in college teaching self-efficacy.

Conversely, Eccles' (1989) research does seem to contribute to an understanding of the sex differences found in regards to teaching with technology self-efficacy. Here, men were found to have significantly higher self-efficacy. When noting means (see Table L1), both sexes have lower teaching with technology self-efficacy than college teaching self-efficacy; however, the difference between the two means for men is 0.217. The difference between the two for women is 1.033, which is nearly five times that of men. Given the non-discipline specific nature of the technical knowledge required to master the skills to teach with technology, it is likely that the observations made by Eccles (1989) could be contributing to this difference. Further, it has also been shown that men typically have higher computer self-efficacy than women (Busch, 1995). This could also contribute to this study's finding. Sex differences regarding beliefs about teaching, perceptions of computers, interests in computers, and human-computer interaction may be contributing to this finding as well. More research is required to understand this phenomenon.

The other significance found regarding teaching with technology self-efficacy concerns computer skills. It was discovered that significant differences exist between all levels of self-rated computer skills for teaching with technology self-efficacy (see Table

K2). A simple regression for these two variables reveals a significant correlation (r=0.599). For most faculty and GTAs, the technical skills required to teach with technology are not found within the realm of expertise or coursework of their discipline; however, effectively using modern instructional technologies requires strong computer skills. Given this dependency, one might expect to find teaching with technology self-efficacy differences across all levels of computer skills.

The significant findings regarding general self-efficacy are worthy of discussion as well. Described as a human trait in the literature (Chen et al., 2001), it was expected that, like intelligence, it would be normally distributed among a population. It was found, however, that women had significantly higher general self-efficacy than men. This is counter to other studies that have considered general self-efficacy in light of sex where no significant differences were found (Albiero-Walton, 2003; Tong & Song, 2004). Given the lack of similar findings in the literature and the lack of a plausible explanation for this difference, the researcher recommends further research to replicate and validate these findings specifically within higher education.

It was also found that full-time, non-tenure track instructors (n=53) had significantly higher general self-efficacy than associate professors (n=91). This, too, was unexpected, given that instructors are often marginalized figures within higher education and associate professors have successfully completed the arduous tenure process. If general self-efficacy can be influenced by life experiences as context-specific self-efficacy can be, it would have been expected that associate professors would have had the higher general self-efficacy. Given the lack of similar findings in the literature and the lack of a

Table 4

College Teaching Self-efficacy and Faculty Development Correlation Table

College Teaching Self-efficacy	TLC	TTR	GTA
Pearson Correlation	0.054	-0.023	-0.056
Sig. (2-tailed)	0.145	0.325	0.138
N	381	383	381

plausible explanation for this difference, the researcher recommends additional study to replicate and validate these findings as well.

Analysis of Research Questions Two and Three

The second research question asks, "What are the relationships between the number and type of faculty development experiences and college teaching self-efficacy?" The third research question asks, "What are the relationships between the number and type of faculty development experiences and teaching with technology self-efficacy?"

Results

To determine the strength of the relationship between college teaching self-efficacy and the three types of faculty development experiences (pedagogy, teaching with technology, and GTA preparation / graduate courses on teaching), a correlation analysis was performed using Pearson's *r*. None of those three variables significantly correlates with college teaching self-efficacy (see Table 4). When considering the GTA sub-population (n=34) in isolation, no significant correlation was found between GTA preparation / graduate courses on teaching and college teaching self-efficacy (r=-0.109).

As with college teaching self-efficacy, to determine the strength of the relationship between teaching with technology self-efficacy and the three types of faculty

Table 5

Teaching with Technology Self-efficacy and Faculty Development Correlation Table

Teaching w/ Technology Self-efficacy	TLC	TTR	GTA
Pearson Correlation	-0.017	0.026	-0.014
Sig. (2-tailed)	0.369	0.304	0.391
N	377	379	382

development experiences (pedagogy, teaching with technology, and GTA preparation / graduate courses on teaching), a correlation analysis was performed using Pearson's *r*. None of those three variables significantly correlates with teaching with technology self-efficacy (see Table 5). When considering the GTA sub-population (n=34), no significant correlation was found between GTA preparation / graduate courses on teaching and teaching with technology self-efficacy (r=-0.018).

Discussion

The expected results of these two research questions were that a significant relationship would exist between the number and type of faculty development experiences and the two types of teaching self-efficacies. The correlation between college teaching self-efficacy and faculty development that focuses, in general, on pedagogy (i.e., TLC) was expected to be strong; however, no significant correlation was found. Further, the correlation between teaching with technology self-efficacy and faculty development that focuses, in general, on teaching with technology (i.e., TTR center) was expected to be strong as well; however, no significant correlation was found.

Table 6

Predictive Value of Faculty Development Participation on Teaching Self-efficacy

Self-efficacy Type	r	r Square
College Teaching	0.095	0.009
Teaching with Technology	0.043	0.002

Analysis of Research Question Four

The fourth research question asks, "Do faculty development experiences predict college teaching self-efficacy or teaching with technology self-efficacy?"

Results

Using multiple regressions, the collective predictive value of faculty development experiences (pedagogy and teaching with technology) on both types of teaching self-efficacy was determined. It is quite poor, accounting for less than one percent of the variability in either type of self-efficacy. Table 6 offers a summary of these results.

Because graduate students have the additional development opportunity of GTA preparation / graduate courses on teaching, the collective predictive value of faculty development experiences (pedagogy, teaching with technology, and GTA preparation / graduate courses on teaching) on both types of teaching self-efficacy was determined for the GTA sub-population. The predictive ability of this model is also exceptionally poor (see Table 7).

Considering the collective predictive value of faculty development experiences in another way, a new variable was created which added the three faculty development experiences (TLC + TTR + GTA training/graduate courses on teaching) together. This

Table 7

Predictive Value of GTA Development on Teaching Self-efficacy (GTA sub-population)

Self-efficacy Type	r	r Square
College Teaching	0.152	0.062
Teaching with Technology	0.095	0.009

new variable's mean was 3.9821 (n=384). When correlated with college teaching self-efficacy and teaching with technology self-efficacy, neither was found to be significant (r=.053 and r=.071, respectively).

Discussion

Given the results of research questions two and three, it was expected that the collective predictive value of TLC and TTR would be exceptionally poor. They account for less than one percent of the variability in either type of self-efficacy. It also follows that the inclusion of GTA preparation / graduate courses on teaching for the GTA sub-population would not be significant either. The total faculty development experiences variable is an exceptionally weak predictor as well. It should also be noted that ongoing support after faculty development experiences might have a more significant connection to self-efficacy than faculty development events themselves.

Analysis of Research Question Five

The fifth and final research question concerns instructional technology-based innovation-decision stage and the three types of self-efficacy. "What are the relationships between general self-efficacy, college teaching self-efficacy, teaching with technology self-efficacy, and instructional technology-based innovation-decision stage

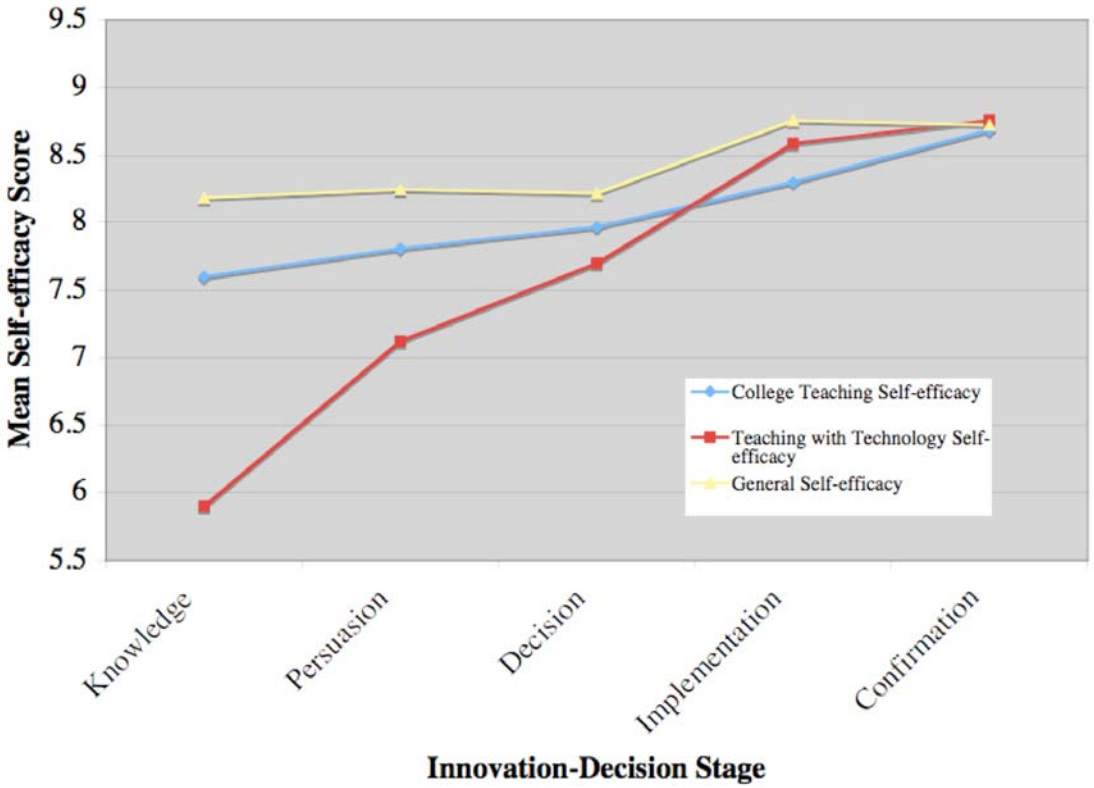

Figure 2. *Comparison of self-efficacy means across innovation-decision stage*

for faculty in higher education? Do self-efficacy scores predict innovation-decision process stage for those in the process of adopting instructional technologies? Is this true regardless of demographic variables?"

Results

A summary of the response results regarding instructional technology-based innovation-decision stage can be found in Table K9. To begin to answer these questions, an analysis of variance was used. It was found that innovations-decision stage did vary significantly based upon one's level of college teaching self-efficacy, $F(4,385) = 4.454$, $p<.05$. Tukey's post hoc test revealed that significant differences only existed, however, between the knowledge and implementation stages and the knowledge and confirmation stages. It was also found that innovations-decision stage did vary significantly based

upon one's level of teaching with technology self-efficacy, $F(4,381) = 27.403$, $p<.01$. Tukey's post hoc test revealed that significant differences existed between all stages except the persuasion and decision stages, the implementation and confirmation stages, and the decision and confirmation stages. Further, it was found that instructional technology-based innovation-decision stage did vary significantly based upon one's level of general self-efficacy, $F(4,383) = 3.136$, $p<.05$. Tukey's post hoc test showed that the sites of significant differences were between the knowledge and implementation stages and the decision and implementation stages. Figure 2 charts the means for each type of self-efficacy across the five instructional technology-based innovation-decision stages and underscores the finding that significant differences exist between most stages for teaching with technology self-efficacy.

To determine the strength of the relationships between general self-efficacy, teaching self-efficacy, teaching with technology self-efficacy, and instructional technology-based innovation-decision stage, simple regression was used, pairing each of the variables. A summary of those findings can be found in Table 8. All correlations were significant at the .01-level. Looking specifically at the correlation between self-efficacy type and instructional technology-based innovation-decision stage, the r^2 value is 0.213 for teaching with technology. This is over five times greater than that of college teaching self-efficacy (r^2=0.042) and reveals that 21.3 percent of the variability in instructional technology-based innovation-decision stage can be accounted for by teaching with technology self-efficacy. The correlation between college teaching self-efficacy and general self-efficacy should also be noted (r^2=0.334). Using multiple regression, where all three self-efficacy types were seen as predictor variables and

Table 8

Correlations for Self-efficacy Types and Innovation-Decision Stage

Scales	1	2	3	4
Faculty and GTAs (n ranges from 385 – 390)				
1. College Teaching	-	.241**	.578**	.206**
2. Teaching with Technology		-	.228**	.462**
3. General			-	.137**
4. Innovation-Decision Stage				-

**$p < .01$

instructional technology-based innovation-decision stage was the criterion, the resulting R was 0.473 (R^2=0.224).

To further explore the connections between self-efficacy types and instructional technology-based innovation-decision stage, the data set was stratified by the demographic variables and the simple regressions run again for those sub-populations. This revealed that the correlation between college teaching self-efficacy and instructional technology-based innovation-decision stage was not significant at the 0.05-level for 26 out of 48 of the sub-groupings (for example, full-professors, those with masters degrees, those in their thirties, etc.). Regarding the correlation between general self-efficacy and instructional technology-based innovation-decision stage, it was not significant for 27 of the sub-groups. Both of these findings were partly due to the small number of respondents in some sub-groups; however, for teaching with technology self-efficacy and instructional technology-based innovation-decision stage, the correlation did not exist at the 0.05-level for only three of the subgroups.

Discussion

Although described above with their statistics, for the sake of clarity, what follows is a summary of the significant findings regarding the three types of self-efficacy and innovation-decision stage. It is important to recall that innovation-decision stage refers to Rogers' (2003) conception of the process through which individuals progress as they adopt an innovation. The innovation under consideration in this study is instructional technology:

- When considering college teaching self-efficacy and instructional technology-based innovation-decision stage, it was found that this form of self-efficacy varies significantly between the knowledge and implementation stages and the knowledge and confirmation stages (see Figure 2 and Table 8); the correlation between these two variables was found to be significant (r=.206);
- General self-efficacy varies between the knowledge and implementation stages and the decision and implementation stages (see Figure 2 and Table 8); the correlation between these two variables is significant as well (r=.137);
- The data revealed that teaching with technology self-efficacy varies significantly (r=.462) between most instructional technology-based innovation-decision stages. The only sites of statistically non-significant differences were between the persuasion and decision stages, the implementation and confirmation stages, and the decision and confirmation stages (see Figure 2 and Table 8); the correlation between these two variables is also significant (r=.462);
- Significant correlations were found between all four variables (instructional technology-based innovation-decision stage and the three self-efficacy variables);

however, the strongest correlations were found between teaching with technology self-efficacy and instructional technology-based innovation-decision stage (r=0.462) and college teaching and general self efficacies (r=0.578);

- It was found that when considering sub-groupings of each demographic variable, the correlation between teaching with technology self-efficacy and instructional technology-based innovation-decision stage continued to exist for 45 out of 48 of these sub-populations; and
- Using multiple regression, it was found that by using all three self-efficacy variables, 22.4 percent of the variance in instructional technology-based innovation-decision stage could be explained; however, this is only slightly higher than using only teaching with technology self-efficacy (21.3 percent).

The theoretical expectation for this research question was that those with higher teaching with technology self-efficacy would be farther along in the process of adopting instructional technologies than those with less teaching with technology self-efficacy. This was confirmed. Lichty (2000) informed the positing of this question by finding a correlation between these two variables (n=98, r=.418) for faculty teaching the basic science curriculum for first and second year students in a medical school. This suggested that an examination of this correlation might provide further insights. The current research has confirmed her findings with a larger sample size across graduate and undergraduate programs at a large, Research I institution which lacks a medical school (n=386, r=.462). Looking for and confirming this correlation for 45 out of the 48 sub-populations provided by the demographic variables enhances the generalizability of this

correlation across teaching populations in higher education. Confirming Lichty's finding encourages the further exploration of the nature of this correlation.

Giving direction for this exploration is the work of those in the health-related behavior change field. Although the language is slightly different, researchers interested in overt behavior change, such as the cessation of smoking and other addictive behaviors (DiClemente et al., 1991), the adoption of exercise regiments (Marcus et al., 1992), and the use of contraceptives (Galavotti et al., 1995), articulate behavioral change in ways that mirror the innovation-decision process. In their "stages of change" model, like the innovation-decision process, there are five stages. While the descriptions of the stages parallel those in the innovation-decision process, the labels for their stages differ and are as follows: pre-contemplation, contemplation, preparation, action, and maintenance (DiClemente et al., 1991; Galavotti et al., 1995; Marcus et al., 1992; Prochaska & DiClemente, 1983).

Galavotti et al. (1995) considered the adoption of contraceptives in light of self-efficacy and the stages of change process. Analysis of variance was used to compare self-efficacy scores between the five stages. They found that self-efficacy scores significantly increase after the pre-contemplative stage and increase progressively higher at each additional stage. Further, all self-efficacy results between stages were found to be significant at the .001 level. Similar findings regarding self-efficacy and a stages view of behavior change have been duplicated in studies concerning the cessation of smoking (DiClemente et al., 1991) and the adoption of an exercise regiment (Marcus et al., 1992).

Following the data analysis procedures used in these studies, the current research discovered an identical trend where teaching with technology self-efficacy is higher in

each subsequent innovation-decision stage for the adoption of instructional technologies (see Figure 2); however, significance was not found between the last stage (confirmation) and the two stages prior (decision and implementation). The non-significant finding may have been due to the possibility that teaching with technology self-efficacy peaks once a faculty member reaches the confirmation stage and doesn't significantly increase as time passes. This lack of significance could have also been due to the small number of respondents who were available in the confirmation stage (n=15, ~4 percent, see Table 8). Bandura (1997) posits that positive enactive mastery experiences increase context-specific self-efficacy over time. Those in the confirmation stage, by definition, continue to have success with that innovation or else they would discontinue its usage (Rogers, 2003). This suggests that the small number of respondents in the confirmation stage is the likely answer, rather than there being no difference in the final two stages of the innovation-decision process.

As an activity of additional data exploration, the researcher merged those in the implementation and the confirmation stages and the analysis of variance was then reconsidered with only four stages. Here, significant differences were found between all four stages at the .05 level. A much larger sample across multiple institutions would be ideal to clearly determine the true relationship between teaching with technology self-efficacy scores of those in the last two stages of the innovation-decision process.

The adoption of innovations is a process similar to other forms of behavioral change. Given that the current findings and those from the health-related behavioral change field confirm the relationship between self-efficacy and stages models of behavioral change, it is reasonable to suspect that they would be generalizable to any

field, discipline, or context in which behavior change or innovation adoption is being articulated in terms of a stages of change model that has similarity to the models under consideration.

Given this connection, the larger question then becomes what are the practical implications of this knowledge for higher education and faculty development? The health-related behavior field offers some guidance on this as well. Within the context of self-efficacy and the adoption of exercise regiments, Marcus et al. offers the following:

> Individuals at various stages have different degrees of exercise-specific self-efficacy. This suggests that individuals at the different stages might benefit from interventions that differ in their focus on enhancing efficacy expectations (1992, p. 64).

Their recommendation for an intervention is analogous to a recommendation to employ a change agent who overtly incorporates self-efficacy enhancing activities into their interactions with clients. This summation is consistent with the work of others in the health-related behavior field. When considering self-efficacy and alcoholism treatment, DiClemente (1986) concluded that self-efficacy evaluations "if accurately assessed, offer a means of developing more effective relapse prevention programs and (we may hope) of predicting maintenance of sobriety" (p. 313). This is also consistent with broad recommendations regarding general change agent strategies offered by Rogers (2003) and Zaltman and Duncan (1977). For Marcus et al. (1992), the assumption is that the specific benefit of enhanced self-efficacy is accelerated movement forward through a stages of change process toward the adoption of an exercise plan. They also recommend tailoring intervention messages based upon a client's current stage of change. This, too, is

consistent with the advice provided by the change agent literature. Marcus et al. further note that additional research in this area is needed before best practices regarding optimal strategies can be offered for increasing self-efficacy regarding exercise regiments (1992).

Given the general characteristics shared by diffusion research and overt behavior change research -- including an overarching desire to change individual behavior, a five-stages view of the underlying processes of behavior change, and the value placed upon interventions by agents in the stages process -- it is reasonable to conclude that these recommendations provide reasonable lines of inquiry for faculty development. Collectively considering these research findings, the following summary includes conclusions and recommendations as they relate to higher education and faculty development:

- Adopter teaching with technology self-efficacy increases from one stage in the instructional technology-based innovation-decision process to the next,
- Adopter teaching with technology self-efficacy may be positively influenced by effective change agents,
- Teaching with technology self-efficacy scores have significant predictive value when it comes to determining the instructional technology-based innovation-decision stage of a given adopter, and
- Extrapolating from the health-related behavior change field, it may be the case that stratifying teaching faculty by innovation-decision stage in faculty development sessions would enable faculty developers to more effectively provide efficacy-enhancing activities that are specific to the needs of that audience.

Following these conclusions, new research questions arise:

- Given the correlation between teaching with technology self-efficacy and instructional technology-based innovation-decision stage, will increasing teaching with technology self-efficacy accelerate the rate at which an adopter passes from one stage to the next? In other words, will an increase in teaching with technology self-efficacy result in a faster adoption rate?
- Given that effective change agents have been shown to positively influence self-efficacy, what faculty development strategies might effectively increase teaching with technology self-efficacy?

Research into these questions is required before meaningful changes can be recommended regarding faculty development practices.

Upon considering these conclusions, it should be noted that the context in which this study is positioned assumes that there are a variety of social and technological forces which are accelerating the need for change in higher education (Duderstadt, 2000). As a result, the ability to increase the adoption rate of innovations (including technological, pedagogical, and cultural innovations) within faculty populations is seen as increasingly crucial. This research sets a direction upon which this line of inquiry can be further pursued. It should also be noted that these recommendations and conclusions represent an interdisciplinary approach in that core concepts of diffusion theory are the foundations upon which this study was predicated. As documented in the review of literature, faculty development practices rarely evoke the work of diffusion studies or change agent theory. It is further recommended that as faculty development strategies are created, modified,

and tested, change literature be consulted to determine the role it might have in informing the development of these practices.

Summary

In review, there were three main areas of exploration by this study. They include a consideration of how self-efficacy scores vary based upon demographic variables; the impact of faculty development on different self-efficacy types; and the connections between different self-efficacy types and the innovation-decision process with regard to the adoption of instructional technologies. Most important among the findings were that women have significantly higher college teaching self-efficacy and general self-efficacy than men; however, men have higher teaching with technology self-efficacy. Also, those in their forties, fifties, and sixties have higher college teaching self-efficacy than those in their twenties, and full-time instructors have higher college teaching self-efficacy than doctoral GTAs and assistant professors. Those who rate themselves as having higher computer skills also have higher teaching with technology self-efficacy. No significant correlations were found between the number of faculty development experiences attended and any type of self-efficacy under consideration. Finally, when considering teaching with technology self-efficacy and instructional technology-based innovation-decision stage, it was found that this form of self-efficacy differs significantly between most stages and consistently increases from the knowledge stage through the confirmation stage (see Figure 2).

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Appendix A

IRB Approval

VirginiaTech

Office of Research Compliance
1880 Pratt Drive (0497)
Blacksburg, Virginia 24061
540/231-4358 Fax: 540/231-0959
E-mail: ctgreen@vt.edu
www.irb.vt.edu

FWA00000572(exp:rnn 7/20/07)
IRB # is IRB00000867.

DATE: February 13, 2007

MEMORANDUM

TO: David (Mike) Moore
Charles Watson

FROM: Carmen Green

SUBJECT: **IRB Exempt Approval:** "Investigating the Relationships Between College Teaching Self-Efficacy and the Innovative-Decision Process" , IRB # 07-077

I have reviewed your request to the IRB for exemption for the above referenced project. I concur that the research falls within the exempt status. Approval is granted effective as of February 13, 2007.

As an investigator of human subjects, your responsibilities include the following:

1. Report promptly proposed changes in previously approved human subject research activities to the IRB, including changes to your study forms, procedures and investigators, regardless of how minor. The proposed changes must not be initiated without IRB review and approval, except where necessary to eliminate apparent immediate hazards to the subjects.

2. Report promptly to the IRB any injuries or other unanticipated or adverse events involving risks or harms to human research subjects or others.

cc: File

Invent the Future

VIRGINIA POLYTECHNIC INSTITUTE UNIVERSITY AND STATE UNIVERSITY

An equal opportunity, affirmative action institution

Appendix B

Initial E-Mail to Teaching Faculty and GTAs Inviting Participation

E-Mail Subject Line: Research Study Participation Request

Dear Teaching Faculty and GTAs,

As someone who is teaching at least one course during the spring 2007 semester at Virginia Tech, you are invited to participate in a research study designed to help me better understand the underlying psychological factors that influence the adoption of new teaching practices and new instructional technologies. Participation is voluntary.

To participate, simply click the following web address:

http://www.filebox.vt.edu/users/edwatson/consent.html

The link will take you to an informed consent form that outlines the details of this study. After submitting this form, you will automatically be taken to the survey. It is estimated that it will take you approximately 10 to 15 minutes to complete. It would be most appreciated if you would complete this survey prior to February 28, 2007.

While the only expected benefits for your participation in this study are those derived from the process of reflecting upon your own teaching, a more tangible benefit is that the results of this study will influence faculty development practices at our institution and beyond; however, no promise or guarantee of benefits are being made to encourage you to participate.

Thank you for considering this survey.

Sincerely,

C. Edward Watson

Appendix C

Reminder E-Mail to Teaching Faculty and GTAs Inviting Participation

E-Mail Subject Line: Reminder: Research Study Participation Request

Dear Teaching Faculty and GTAs,

Please Note: Survey Closes on Wednesday, February 28, 2007.

As someone who is teaching at least one course during the spring 2007 semester at Virginia Tech, you are invited to participate in a research study designed to help me better understand the underlying psychological factors that influence the adoption of new teaching practices and new instructional technologies. Participation is voluntary.

To participate, simply click the following web address:

http://www.filebox.vt.edu/users/edwatson/consent.html

The link will take you to an informed consent form that outlines the details of this study. After submitting this form, you will automatically be taken to the survey. It is estimated that it will take you approximately 10 to 15 minutes to complete.

While the only expected benefits for your participation in this study are those derived from the process of reflecting upon your own teaching, a more tangible benefit is that the results of this study will influence faculty development practices at our institution and beyond; however, no promise or guarantee of benefits are being made to encourage you to participate.

I apologize if you have received this message even though you have already participated in this study. Given respondent anonymity, I am unable to selectively resend this reminder to those that have yet to respond.

Thank you for considering this survey.

Sincerely,

C. Edward Watson

Appendix D

Final Reminder E-Mail to Teaching Faculty and GTAs Inviting Participation

Dear Teaching Faculty and GTAs,

Final Reminder: Survey Closes Tomorrow (Wednesday) Night

As someone who is teaching at least one course during the spring 2007 semester at Virginia Tech, you are invited to participate in a research study designed to help me better understand the underlying psychological factors that influence the adoption of new teaching practices and new instructional technologies. Participation is voluntary.

To participate, simply click the following web address:

http://www.filebox.vt.edu/users/edwatson/consent.html

The link will take you to an informed consent form that outlines the details of this study. After submitting this form, you will automatically be taken to the survey. It is estimated that it will take you approximately 10 to 15 minutes to complete.

While the only expected benefits for your participation in this study are those derived from the process of reflecting upon your own teaching, a more tangible benefit is that the results of this study will influence faculty development practices at our institution and beyond; however, no promise or guarantee of benefits are being made to encourage you to participate.

I apologize if you have received this message even though you have already participated in this study. Given respondent anonymity, I am unable to selectively resend this reminder to those that have yet to respond. Thank you to everyone that has participated.

Thank you for considering this survey.

Sincerely,

C. Edward Watson

Appendix E

Text for Online Informed Consent Form for Survey Participants

Title of Project:

Investigating the Relationships between College Teaching Self-Efficacy and the Innovation-Decision Process

Investigator:

C. Edward Watson, School of Education and Educational Technologies, Virginia Tech

Research Advisor:

David M. Moore, School of Education, Virginia Tech

I. Purpose of this Research Project

The purpose of this research study is to investigate the underlying psychological factors that influence the adoption of new teaching practices and new instructional technologies in higher education. All faculty and GTAs teaching courses during the spring semester 2007 will receive this survey.

II. Procedures

In addition to reading this form and submitting your consent to participate in this study, you are encouraged to print it for your records. After providing consent, you will then be asked to complete a survey that will begin by requesting demographic information. It will also ask for your level of confidence regarding a variety of activities. The majority of these will focus on teaching. The survey will conclude with questions regarding the decision-making process you follow as you decide to adopt an instructional technology. Upon submitting this survey, the procedure will be complete. It is estimated that you will be able to complete this procedure in 10 to 15 minutes.

III. Risk

There are no anticipated risks to you as a result of participating in this study.

IV. Benefits

While the only expected benefits for your participation in this study are those derived from the process of reflecting upon your own teaching, a more tangible benefit is that the results of this study will influence faculty development practices at our institution and beyond. However, no promise or guarantee of benefits is being made to encourage you to participate.

V. Extent of Anonymity and Confidentiality

Your participation in this study will be completely anonymous, and data will be analyzed and described in aggregate form only. Further, when publishing the results of this study, the name of our university will not be included. It is possible that the Institutional Review Board (IRB) may view this study's collected data for auditing purposes; however, since this is an anonymous survey, your identity would not be compromised. The IRB is responsible for the oversight of the protection of human subjects involved in research.

VI. Compensation

Participants will not be compensated for participating in this study.

VII. Freedom to Withdraw

You are free to withdraw from this study at any time; to do so, please quit out of your web browser. Further, you may refuse to answer any questions you don't want to answer and still remain in the study.

VIII. Subject's Responsibilities and Permission

I voluntarily agree to participate in this study. I have the following responsibilities:

- Submit this "Informed Consent" form,
- Fill out the survey that follows, and
- Submit it once complete.

I have read this Informed Consent Form and the conditions of this project. By clicking the "Provide Consent" button below, I have had all of my questions answered, agree to participate in this study, and accept that my consent will be electronically supplied to the researcher to document my participation in this study.

["Provide Consent" button located here on the online form]

Should you have any questions about this research or its conduct, you may contact any of the following:

Investigator:	C. Edward Watson	1-4234	edwatson@vt.edu
Faculty Advisor:	D. Mike Moore	1-6016	moorem@vt.edu
Chair, IRB:	David M. Moore	1-4991	moored@vt.edu

Appendix F

Study's Survey Instrument

College Teaching Self-Efficacy and the Innovation-Decision Process Survey

(NOTE: Self-efficacy is a judgment an individual has regarding his/her personal capability to be successful on a future task; it varies depending upon the task under consideration.)

Instructions: This survey consists of five parts and will ask you for demographic information as well as your perceptions and opinions regarding your confidence performing a variety of activities / tasks associated with your teaching process. Each part of this survey has its own set of instructions. **Please read those instructions carefully before beginning each part**. Thank you for taking the time to provide answers to this survey.

Part One: Demographic Information

Please supply the following information regarding your experiences and background.

Gender:
__ Male
__ Female

Age:
__ 20 to 29
__ 30 to 39
__ 40 to 49
__ 50 to 59
__ 60 to 69
__ 70 or above

Highest Degree Held:
__ Doctorate
__ Masters
__ Bachelors
__ Other (Please specify):_____

Professional Rank:
__ Professor
__ Associate Professor
__ Assistant Professor
__ Instructional Faculty (Full-time, Non-Tenure Track)
__ Adjunct Instructional Faculty (Part-time, Non-Tenure Track)
__ A/P (Administrative/Professional) Faculty
__ Doctoral-level Graduate Teaching Assistant (GTA)
__ Masters-level Graduate Teaching Assistant (GTA)
__ Other (Please Specify):

How many years have you taught on the college level?
__ 1 year or less
__ 1 to 3 years
__ 3 to 5 years
__ 6 to 10 years
__ 11 to 15 years
__ 16 to 20 years
__ 21 to 25 years
__ 26 to 30 years
__ 31 or more years

How many students are in the courses you typically teach?
__ less than 25 students
__ between 25 and 50 students
__ 51 to 100 students
__ 100 to 200 students
__ more than 200 students
__ My class sizes vary

In which department do you most often teach (Please use the two to four letter abbreviation used in the Timetable of Classes)? _____

In which college do you most often teach?
__ Agriculture and Life Sciences
__ Architecture and Urban Studies
__ Business
__ Engineering
__ Liberal Arts and Human Sciences
__ Natural Resources
__ Science
__ Veterinary Medicine

Rate your computer skills:
__ Expert
__ Above Average
__ Average
__ Below Average
__ Novice

What type of computer do you prefer?
__ Windows
__ Macintosh
__ Linux
__ Other (Please Specify):_____

How many TLC (Teaching and Learning Center) or TLC-sponsored workshops, guest lectures, or retreats have you attended within the past three years (since January 2004)?
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 or more

How many TTR center (Technology for Teaching and Research) or TTR-sponsored workshops / panel discussions have you attended within the past three years (since January 2004)? These are spring and/or fall semester workshops and typically last for two hours.
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 or more

When was the last time you participated in one of the TTR center's two or three-day summer tracks (if you opted for a spring version of a summer track in the past, please consider that as summer track participation as you develop your response)?

__ I am currently participating in a spring track.
__ I participated in 2006.
__ I participated in 2005.
__ I participated in 2004.
__ I participated in 2003.
__ It has been five years or longer since I last participated in an TTR track.
__ I have never participated in the TTR track program.

Which of the following college teaching preparatory courses have you taken at Virginia Tech (check all that apply)?
__ I have not taken any of the following.
__ GRAD 5004 - GTA Training Workshop
__ GRAD 5104 - Preparing the Future Professoriate
__ GRAD 5114 - Pedagogical Practices in Contemporary Contexts
__ GRAD 5974 - Pedagogy Independent Study with Dr. Shelli Fowler
__ GRAD 5984 - Critically-Engaged Teaching with Advanced Technologies
__ EDCI 6644 - College Teaching
__ I took a GTA training course within my college/department.

Part Two:

Please indicate how confident you are in your ability to accomplish the teaching-related activities/tasks listed below. As you consider each statement, ask yourself "How confident am I in my ability to..."

Response Key:

0	1	2	3	4	5	6	7	8	9	10
No Confidence					Confident					Very Confident

Specify the learning goals that I expect my students to attain?
0 1 2 3 4 5 6 7 8 9 10

Actively engage my students in the learning activities that I include in my teaching plan/syllabus?
0 1 2 3 4 5 6 7 8 9 10

Create a positive classroom climate for learning?
0 1 2 3 4 5 6 7 8 9 10

Reflect on my teaching practice with the aim of making appropriate improvements?
0 1 2 3 4 5 6 7 8 9 10

Develop different assessment methods for my students based upon the learning goals I want to check?
0 1 2 3 4 5 6 7 8 9 10

Evaluate the effectiveness of my own teaching in light of my students' feedback to me?
0 1 2 3 4 5 6 7 8 9 10

Promote student participation in my classes?
0 1 2 3 4 5 6 7 8 9 10

Use different evaluation methods?
0 1 2 3 4 5 6 7 8 9 10

Prepare the teaching materials I will use?
0 1 2 3 4 5 6 7 8 9 10

Ensure that my students resolve the difficulties they encounter while learning?
0 1 2 3 4 5 6 7 8 9 10

Promote a positive attitude towards learning in my students?
0 1 2 3 4 5 6 7 8 9 10

Adapt my teaching practices in response to my students' evaluations of my teaching?
0 1 2 3 4 5 6 7 8 9 10

Evaluate accurately my students' academic capabilities?
0 1 2 3 4 5 6 7 8 9 10

Decide on the most appropriate evaluation method for a particular course?
0 1 2 3 4 5 6 7 8 9 10

Ensure that my students consider themselves capable of learning the material in my class?
0 1 2 3 4 5 6 7 8 9 10

Employ methodical processes that permit me to assess my own teaching?
0 1 2 3 4 5 6 7 8 9 10

Give my students feedback about their progress?
0 1 2 3 4 5 6 7 8 9 10

Clearly identify my course objectives?
0 1 2 3 4 5 6 7 8 9 10

Maintain high academic expectations?
0 1 2 3 4 5 6 7 8 9 10

Use information derived from my own self-reflection to improve my teaching?
0 1 2 3 4 5 6 7 8 9 10

Adequately grade my students' exams and assignments?
0 1 2 3 4 5 6 7 8 9 10

Adapt to the needs of my students (motivation, interest, prior knowledge, etc.) when planning my courses?
0 1 2 3 4 5 6 7 8 9 10

Think of my students as active learners, which is to say knowledge constructors rather than information receivers?
0 1 2 3 4 5 6 7 8 9 10

Provide support and encouragement to students who are having difficulty learning?
0 1 2 3 4 5 6 7 8 9 10

Update my knowledge of the subject I am teaching?
0 1 2 3 4 5 6 7 8 9 10

Provide my students with detailed feedback about their academic progress?
0 1 2 3 4 5 6 7 8 9 10

Modify and adapt my syllabus if my students' needs require it?
0 1 2 3 4 5 6 7 8 9 10

Permit my students to prepare and/or develop some of the course units?
0 1 2 3 4 5 6 7 8 9 10

Calmly handle any problems that may arise in the classroom?
0 1 2 3 4 5 6 7 8 9 10

Develop my teaching skills using various means (attending conferences, reading about pedagogy, talking to other professionals…)?
0 1 2 3 4 5 6 7 8 9 10

Gather information about my students' academic progress during the process of an instructional unit prior to the final assessment of that unit?
0 1 2 3 4 5 6 7 8 9 10

Encourage my students to ask questions during class?
0 1 2 3 4 5 6 7 8 9 10

Make students aware that I have a personal investment in them and in their learning?
0 1 2 3 4 5 6 7 8 9 10

Evaluate the degree to which my course objectives have been met?
0 1 2 3 4 5 6 7 8 9 10

Design the structure and content of each class?
0 1 2 3 4 5 6 7 8 9 10

Let students take initiative for their own learning?
0 1 2 3 4 5 6 7 8 9 10

Show my students respect through my actions?
0 1 2 3 4 5 6 7 8 9 10

Be flexible in my teaching even if I must alter my plans?
0 1 2 3 4 5 6 7 8 9 10

Make students aware of the relevance of what they are learning?
0 1 2 3 4 5 6 7 8 9 10

Master the material that I cover in class?
0 1 2 3 4 5 6 7 8 9 10

Promote my students' confidence in themselves?
0 1 2 3 4 5 6 7 8 9 10

Make my students feel that their academic success is due to their own efforts?
0 1 2 3 4 5 6 7 8 9 10

Spend the time necessary to plan my classes?
0 1 2 3 4 5 6 7 8 9 10

Select the appropriate materials for each class?
0 1 2 3 4 5 6 7 8 9 10

Part Three:

The following statements refer to attitudes about using computers-based technologies (e.g., Blackboard, PowerPoint, student response systems (clickers), discipline-specific software, etc.) for instructional purposes. Indicate your level of agreement with each statement by choosing a number from 0 to 10.

Response Key:

0	1	2	3	4	5	6	7	8	9	10
Strongly Disagree					Neutral					Strongly Agree

I am continually seeking better ways to use the computer in my instruction.
0 1 2 3 4 5 6 7 8 9 10

I use the computer just as effectively as I do other non-technology-based instructional tools and resources.
0 1 2 3 4 5 6 7 8 9 10

I know the steps necessary to use the computer in an instructional setting.
0 1 2 3 4 5 6 7 8 9 10

I am effective in employing computer resources for instruction.
0 1 2 3 4 5 6 7 8 9 10

I understand computer capabilities well enough to be effective in using the computer for instruction.
0 1 2 3 4 5 6 7 8 9 10

I find it easy to explain to students how to use computer applications.
0 1 2 3 4 5 6 7 8 9 10

I am able to answer students' questions related to the computer.
0 1 2 3 4 5 6 7 8 9 10

I have confidence that I have the necessary skills to use the computer for instruction.
0 1 2 3 4 5 6 7 8 9 10

I would invite my peers to evaluate my computer-based instruction.
0 1 2 3 4 5 6 7 8 9 10

I enjoy using computers whenever I can.
0 1 2 3 4 5 6 7 8 9 10

Part Four:

The following questions concern your overall level of confidence to perform effectively across different tasks and situations. Indicate your level of agreement with each statement by choosing a number from 0 to 10.

Response Key:

0	1	2	3	4	5	6	7	8	9	10
Strongly Disagree					Neutral					Strongly Agree

I will be able to achieve most of the goals that I have set for myself.
0 1 2 3 4 5 6 7 8 9 10

When facing difficult tasks, I am certain that I will accomplish these tasks.
0 1 2 3 4 5 6 7 8 9 10

In general, I think I can obtain outcomes that are important to me.
0 1 2 3 4 5 6 7 8 9 10

I believe I can succeed at most any endeavor to which I set my mind.
0 1 2 3 4 5 6 7 8 9 10

I will be able to successfully overcome many challenges.
0 1 2 3 4 5 6 7 8 9 10

I am confident that I can perform effectively on many different tasks.
0 1 2 3 4 5 6 7 8 9 10

Compared to other people, I can do most tasks very well.
0 1 2 3 4 5 6 7 8 9 10

Even when things are tough, I can perform quite well.
0 1 2 3 4 5 6 7 8 9 10

Part Five:

Deciding to adopt a new product, procedure, or instructional strategy is seen as a process that occurs over time. The following statements are designed to determine where you are in this process with regard to using computer technologies for instruction.

Please select all of the statements that apply to you.

__ I am considering the advantages and disadvantages of computer-based instruction.
__ I will use computer-based instructional programs or strategies during the upcoming academic year.
__ I evaluate student learning using computer-based tools.
__ I read brochures from companies marketing computer-based learning programs.
__ I have secured the technical assistance I need to effectively implement instructional technologies.
__ I have decided not to use computer-based applications or strategies for instruction in my next class.
__ I read journal articles about computer-based applications in my area of specialization.
__ I think about ways to implement computer-based instruction in my courses.
__ I have integrated computer-based instruction into my normal curriculum-planning activities.
__ I have secured funding to support my efforts with computer-based programs.
__ I am creating or previewing computer-based programs for future incorporation into my courses.
__ I have observed demonstrations of technologies and programs for instructional use within my discipline.
__ I will use computer-based instruction on a trial basis during the coming year.
__ I am currently using computer-based technologies in my instruction.
__ I will continue to evaluate my efforts to provide quality computer-based instruction.

Please add comments that provide additional information to assist in understanding your experiences with and attitudes toward using instructional technologies.

[“Submit” button located here on the online survey instrument]

Appendix G

Permission to Use the College Teaching Self-Efficacy Scale (CTSES)

From: Leonor Prieto Navarro <leoprieto@terra.es>
Date: Sun, 14 Jan 2007 09:50:50 +0100
To: <edwatson@vt.edu>
Subject: Autoeficacia docente

Estimado Edward,
Encantada de saludarle. Agradezco mucho su interés por la escala, y por supuesto me complace que la utilice en sus investigaciones, en las que le deseo todo lo mejor. Cualquier información más precisa que requiera sobre el instrumento más adelante no dude en contactar conmigo.

Saludos cordiales desde Madrid.

Dra. Leonor Prieto
Universidad Pontificia Comillas de Madrid (SPAIN)
lprieto@chs.upcomillas.es

> Estimado Dr. Prieto:
>
> Acabo de descubrir su Escala de "Autoeficacia Docente del Profesorado
> Universitario" en este fanástico sitio web de la universidad de Emory sobre la
> auto-eficacia:
>
> http://www.des.emory.edu/mfp/self-efficacy2.html
>
> Le escribo hoy para saber si pudiera tener su permiso para usar dicha escala
> como parte de un estudio que estoy desarollando aqui en la universidad de
> Virginia Tech. El meta de mi estudio es hacerles un sondeo a todos los
> profesores y estudiantes graduados que dan clases aqui en Virginia Tech para
> poder determinar sus necesidades y poder mejorar nuestro programa de desarollo
> profesional. Los resultados también formarán parte de mi tesis doctoral.
>
> Muchísimas gracias por su atención,
>
> Eddie

Note: Translation into Spanish of permission request provided by Dr. Ronald J. Friis, Associate Professor of Spanish, Furman University, Greenville, SC, 29613

Appendix H

Translation of Permission to Use the College Teaching Self-Efficacy Scale (CTSES)

From: Leonor Prieto Navarro <leoprieto@terra.es>
Date: Sun, 14 Jan 2007 09:50:50 +0100
To: <edwatson@vt.edu>
Subject: Autoeficacia docente

Dear Edward:

It's a pleasure hearing from you. I appreciate your interest in the scale and of course it would be my pleasure for you to use it in your research, which I wish you good luck with. If you would like more detailed information about the scale, don't hesitate to get in touch with me.

Sending you best wishes from Madrid,

Dra. Leonor Prieto
Universidad Pontificia Comillas de Madrid (SPAIN)
lprieto@chs.upcomillas.es

> Dear Dr. Prieto,
>
> I discovered your College Teaching Self-Efficacy Scale via Emory University's
> wonderful self-efficacy web site:
>
> http://www.des.emory.edu/mfp/self-efficacy2.html
>
> I write at this time to ask if I may have your permission to use it as part of
> a study I am planning at Virginia Tech. My goal is to survey all teaching
> faculty and graduate students at Virginia Tech in an effort to determine and
> develop better faculty development practices. The results will also figure
> prominently into my doctoral work.
>
> Thank you very much for considering my request.
>
> Eddie

Note: Translation from Spanish into English of permission response provided by Dr. Ronald J. Friis, Associate Professor of Spanish, Furman University, Greenville, SC, 29613

Appendix I

Permission to Use the New General Self-Efficacy (NGSE) Scale

From: Gilad Chen <gchen3@mail.umd.edu>
Organization: University of Maryland
Reply-To: <giladchen@rhsmith.umd.edu>
Date: Sat, 10 Feb 2007 11:57:52 -0500
To: "'C. Edward Watson'" <edwatson@vt.edu>
Subject: RE: Request for Permission to Use "New General Self-Efficacy Scale"

Dear Dr. Watson,
You have permission to use the NGSE scale. And, please do forward me any research article that comes out of this research.
I have attached a word file containing the scale (plus instructions), as well as two papers that provide validity evidence for the scale.
Best of luck with this project!
Gilad

Gilad Chen
Associate Professor of Management & Organization
Robert H. Smith School of Business
4514 Van Munching Hall
University of Maryland
College Park, MD 20742-1815
301-405-0923 TEL
301-920-4521 MOBILE
giladchen@rhsmith.umd.edu
http://www.rhsmith.umd.edu

> Dear Dr. Chen,
>
> I am currently a Ph.D. candidate in the Instructional Design and Technology
> program at Virginia Tech. The focus of my research is on self-efficacy,
> Rogers' Innovation-Decision Process, and Faculty Development. I write at this
> time to ask if I may use your 8-item "New General Self-Efficacy Scale" as part
> of my research instrument. Specifically, I am curious to see the relationship
> between general self-efficacy and college teaching self-efficacy.
>
> If you would like, I would be happy to share with you the results of my
> finding.
>
> Thank you for considering my request.
>
> Eddie

Appendix J

Permission to Use the College Teaching Self-Efficacy Scale (CTSES)

From: Marcia Lichty <lichty@oakland.edu>
Date: Fri, 22 Dec 2006 10:20:07 -0500
To: "'C. Edward Watson'" <edwatson@vt.edu>
Subject: RE: Request for Permission to Use

Eddie,

Thanks for your email and request.

The items in Section 2, Items 1-14 are from

Bannon, Marshal & Fluegal (1985). Cognitve and affective computer attitude scales: A validity study. Educational and Psychological Measurement, 45, 679-681.

The items in Section 2, Items 15-24 are from

Enochs, Riggs & Ellis (1993). The development and partial validation of microcomputer utilization in teaching efficacy beliefs instrument in a science setting. School Science and Mathematics, 93, 257-263.

The items in Section 4, I did develop using Rogers (1995) description of typical behaviors of people in one of the five stages. The major limitation to using the Section 4 instrument is the small sample size.

If you feel the instrument will benefit your efforts, you have my permission to use it.

I hope you enjoy the process. Good Luck!

Marcia Lichty, PhD
Assistant Dean - School of Business Administration
427 Elliott Hall - Oakland University
Rochester, MI 48309-4493

248.370.3274 (Phone)
248.370.4974 (Fax)

> Dear Dr. Lichty,
>
> I am currently a Ph.D. candidate in the Instructional Design and Technology
> program at Virginia Tech. The focus of my research is on self-efficacy,
> Rogers' Innovation-Decision Process, and Faculty Development. I write at this
> time to ask if I may use part of the instrument you developed for your

> dissertation work at Wayne State. Specifically, I would like to use the
> questions related to self-efficacy in the "Section 2 – Attitudes" portion of
> your instrument and all of your questions in Section 4 of your instrument
> (Innovation-Decision Process Indicator).
>
> If you would like, I would be happy to share with you the results of my
> finding.
>
> Thank you for considering my request.
>
> Eddie Watson

Appendix K

This appendix consists of summative tables that describe the collected data.

Table K1

Summary of Responses by Question Area

Question Topic	N	Missing Values
Respondents (N = 394)		
Gender	390	4
Age	392	2
Highest Degree Held	390	4
Faculty / GTA Rank	392	2
Years of Teaching Experience	394	0
Class Size	394	0
Department	375	19
College	391	3
Self-Rating of Computer Skills	394	0
Computer Platform Preference	394	0
Number of TLC Workshops	384	10
Number of TTR Workshops	386	8
Graduate Courses	384	10
Teaching Self-Efficacy	391	3
Teaching with Technology Self-efficacy	387	7
General Self-efficacy	388	6
Innovation-Decision Stage	390	4

Table K2

Respondent Reported Age

Age Range	Number	Percent
20 to 29	42	10.71
30 to 39	96	24.49
40 to 49	101	25.77
50 to 59	96	24.49
60 to 69	54	13.78
70 or above	3	0.01

Table K3

Respondent Reported Professional Rank

Rank	Number	Percent
Full Professor	91	23.21
Associate Professor	91	23.21
Assistant Professor	68	17.35
Instructional, Full-Time, Non-Tenure Track	53	13.52
Administrative / Professional (A/P)	12	3.06
Adjunct, Part-Time, Non-Tenure Track	31	7.91
Doctoral-level Graduate Teaching Assistant (GTA)	23	5.87
Masters-level Graduate Teaching Assistant (GTA)	11	2.81
Other	12	3.06

Table K4

Respondent Reported Years of Teaching Experience

Experience	Number	Percent
1 year or less	30	7.6
1 to 3 years	48	12.2
3 to 5 years	49	12.4
6 to 10 years	59	15.0
11 to 15 years	45	11.4
16 to 20 years	52	13.2
21 to 25 years	47	11.9
26 to 30 years	25	6.3
31 or more years	39	9.9

Table K5

College in Which Respondents Most Often Teach

College	Number	Percent
Agriculture and Life Sciences	46	11.3
Architecture and Urban Studies	22	5.6
Business	30	7.6
Engineering	64	16.2
Liberal Arts and Human Sciences	144	36.5
Natural Resources	15	3.8
Science	65	16.5
Veterinary Medicine	5	1.3

Table K6

Summary of Faculty Development Participation Since January 2004

Number of	TLC		TTR		Graduate	
Workshops	Attended	Percent	Attended	Percent	Attended	Percent
0	168	42.6	104	26.4	317	80.5
1	51	12.9	76	19.3	53	13.6
2	54	13.7	53	13.5	12	3.0
3	39	9.9	40	10.2	2	0.5
4	18	4.6	22	5.6	5	1.3
5	18	4.6	19	4.8	0	0.0
6	15	3.8	24	6.1	0	0.0
7	6	1.5	10	2.5	0	0.0
8	5	1.3	14	3.6	0	0.0
9	1	0.3	4	1.0	0	0.0
10	6	1.5	14	3.6	0	0.0
11	1	0.3	1	0.3	0	0.0
12	2	0.5	4	3.6	0	0.0
13	0	0.0	1	0.3	0	0.0

Table K7

Average and Maximum Number of Respondent Faculty Development Experiences

Development Experiences	N	Mean	Maximum
TLC	384	1.859	12
TTR Center	386	2.744	13
Graduate Courses	389	0.247	4

Table K8

Self-efficacy Scales Response Summary

Self-efficacy	N	Mean	Std. Deviation
College Teaching	391	7.926	1.2711
Teaching with Technology	387	7.335	1.9018
New General	388	8.321	1.1882

Table K9

Innovation-Decision Process Indicator Response Summary

Stage	Number	Percent
Knowledge	83	21.28
Persuasion	113	28.97
Decision	119	30.51
Implementation	60	15.38
Confirmation	15	3.85

Appendix L

This appendix contains the means and standard deviations for all strata within each demographic variable.

Table L1

Means, Standard Deviations, and Ns for Self-efficacy Types Stratified by Sex

Sex	CTSE	TTSE	GSE
Men	7.790, 1.230 (215)	7.573, 1.902 (212)	8.120, 1.178 (213)
Women	8.099, 1.290 (172)	7.066, 1.835 (171)	8.464, 1.178 (171)

Note. Means, then standard deviations, are listed first. The number of respondents is in parentheses.

Table L2

Means, Standard Deviations, and Ns for Self-efficacy Types Stratified by Age

Age	CTSE	TTSE	GSE
20 to 29	7.281, 1.358 (42)	7.244, 1.526 (42)	7.998, 1.405 (41)
30 to 39	7.782, 1.178 (94)	7.618, 1.522 (93)	8.343, 0.980 (94)
40 to 49	8.084, 1.198 (101)	7.355, 2.101 (101)	8.458, 1.084 (100)
50 to 59	8.102, 1.307 (95)	7.475, 1.871 (94)	8.260, 1.294 (94)
60 to 69	8.124, 1.301 (54)	6.710, 2.290 (52)	8.443, 1.288 (54)
70 or above	7.477, 1.260 (3)	6.067, 2.957 (3)	8.583, 1.252 (3)

Note. Means, then standard deviations, are listed first. The number of respondents is in parentheses.

Table L3

Means, Standard Deviations, and Ns for Self-efficacy Types Stratified by Degree

Degree	CTSE	TTSE	GSE
Bachelors	7.946, 1.086 (17)	7.294, 1.526 (17)	8.273, 1.406 (17)
Masters	7.920, 1.314 (94)	7.111, 1.522 (93)	8.437, 1.098 (93)
Doctorate	7.930, 1.278 (275)	7.420, 2.957 (272)	8.290, 1.213 (273)

Note. Means, then standard deviations, are listed first. The number of respondents is in parentheses.

Table L4

Means, Standard Deviations, and Ns for Self-efficacy Types Stratified by Rank

Rank	CTSE	TTSE	GSE
Full Professor	7.967, 1.238 (90)	7.320, 1.914 (87)	8.507, 1.054 (89)
Associate	7.990, 1.222 (91)	7.557, 1.886 (91)	8.039, 1.438 (90)
Assistant	7.647, 1.386 (66)	7.493, 1.622 (66)	8.261, 1.072 (66)
Full-Time Instructors	8.441, 1.062 (53)	7.394, 1.778 (52)	8.734, 0.884 (52)
A/P Faculty	7.839, 1.300 (12)	6.350, 2.698 (12)	8.359, 0.867 (12)
Part-Time, Adjunct	7.683, 1.501 (31)	6.816, 2.355 (31)	8.186, 1.415 (31)
Doctoral-level GTA	7.468, 1.175 (23)	7.252, 1.374 (23)	8.103, 1.024 (23)
Masters-level GTA	7.641, 0.888 (11)	7.000, 1.992 (11)	7.695, 1.228 (11)

Note. Means, then standard deviations, are listed first. The number of respondents is in parentheses.

Table L5

Means, Standard Deviations, and Ns for Self-efficacy Types Stratified by Years of Teaching Experience

Experience	CTSE	TTSE	GSE
1 year or less	7.269, 1.393 (28)	7.364, 1.503 (28)	8.063, 1.263 (89)
1 to 3 years	7.563, 1.338 (48)	7.276, 1.694 (48)	8.228, 1.228 (90)
3 to 5 years	8.038, 1.038 (49)	7.905, 1.589 (49)	8.519, 1.009 (66)
6 to 10 years	7.814, 1.286 (59)	7.164, 2.148 (59)	8.269, 1.049 (52)
11 to 15 years	8.193, 1.247 (45)	7.280, 2.028 (44)	8.429, 1.127 (12)
16 to 20 years	8.146, 1.214 (52)	7.459, 1.729 (52)	8.372, 1.222 (31)
21 to 25 years	8.022, 1.295 (46)	7.538, 1.914 (45)	8.162, 1.395 (23)
26 to 30 years	7.931, 1.531 (25)	6.969, 1.971 (24)	8.255, 1.305 (11)
31 or more years	8.158, 1.059 (39)	6.800, 2.308 (38)	8.490, 1.213 (11)

Note. Means, then standard deviations, are listed first. The number of respondents is in parentheses.

Table L6

Means, Standard Deviations, and Ns for Self-efficacy Types Stratified by Class Size

Number of Students	CTSE	TTSE	GSE
Less than 25	8.012, 1.304 (116)	7.038, 1.944 (115)	8.228, 1.110 (116)
26 to 50	8.085, 1.244 (137)	7.373, 1.862 (134)	8.402, 1.248 (135)
51 to 100	7.802, 1.182 (48)	8.069, 2.615 (48)	8.469, 1.156 (47)
100 to 200	7.430, 1.476 (19)	7.135, 1.259 (19)	8.098, 1.243 (19)
More than 200	7.273, 1.538 (9)	7.598, 1.996 (9)	9.028, 0.879 (9)
Varies	7.758, 1.179 (62)	7.261, 1.899 (62)	8.172, 1.221 (62)

Note. Means, then standard deviations, are listed first. The number of respondents is in parentheses.

Table L7

Means, Standard Deviations, and Ns for Self-efficacy Types Stratified by Department

Department	CTSE	TTSE	GSE
ENGL	8.802, 0.959 (28)	6.952, 1.881 (28)	8.749, 1.023 (28)
BIOL	7.674, 1.166 (15)	6.404, 2.051 (15)	8.458, 1.425 (15)
CHEM	7.383, 1.536 (14)	6.891, 1.898 (14)	8.008, 1.394 (14)
ECE	7.246, 1.265 (14)	7.807, 1.976 (14)	7.760, 1.419 (13)
MATH	8.078, 0.814 (13)	7.485, 1.578 (13)	8.404, 1.412 (13)
PSYC	7.722, 1.182 (13)	7.523, 1.168 (13)	8.452, 1.315 (13)
HD	7.952, 1.101 (10)	7.180, 1.946 (10)	8.575, 1.176 (10)
ACIS	7.198, 0.948 (6)	7.350, 1.392 (6)	7.521, 1.490 (6)
APSC	7.405, 0.461 (5)	7.340, 1.545 (5)	8.000, 1.355 (5)
BIT	7.761, 0.503 (7)	8.929, 0.804 (7)	8.179, 1.196 (7)
CEE	7.927, 1.201 (8)	7.696, 2.254 (8)	8.922, 0.802 (8)
CS	7.770, 0.767 (9)	8.978, 1.089 (9)	8.530, 0.789 (9)
COMM	8.053, 1.314 (7)	6.957, 1.039 (7)	9.000, 1.026 (7)
ELPS	8.605, 1.367 (5)	7.198, 2.086 (5)	8.482, 1.291 (5)
FLL	9.204, 0.907 (8)	7.378, 2.115 (7)	8.906, 1.159 (8)
FOR	8.223, 1.065 (5)	7.360, 2.162 (5)	8.300, 1.223 (5)
HIST	8.043, 1.184 (9)	7.022, 2.396 (9)	8.319, 1.171 (9)
HTM	8.268, 1.154 (5)	7.180, 2.481 (5)	9.075, 1.165 (5)
HNFE	7.292, 1.500 (6)	6.867, 1.741 (6)	7.063, 1.036 (6)

IDST	8.033, 1.484 (6)	6.783, 3.361 (6)	7.967, 1.463 (6)
ISE	7.982, 0.151 (5)	8.000, 1.687 (5)	8.292, 0.680 (5)
ME	8.429, 0.932 (6)	7.750, 1.849 (6)	8.708, 1.489 (6)
MSE	7.679, 1.403 (6)	7.183, 1.848 (6)	7.917, 1.413 (6)
PPWS	7.897, 1.413 (6)	8.183, 1.308 (6)	8.000, 1.886 (6)
SOC	8.343, 1.420 (6)	7.250, 1.877 (6)	7.979, 1.985 (6)
UAP	6.991, 0.941 (5)	5.460, 1.788 (5)	7.225, 1.703 (5)

Note. Means, then standard deviations, are listed first. The number of respondents is in parentheses. Only departments that are represented five or more times in the respondent pool are described above (n=26).

Table L8

Means, Standard Deviations, and Ns for Self-efficacy Types Stratified by College

College	CTSE	TTSE	GSE
Agriculture & LS	7.621, 1.330 (46)	7.245, 1.784 (46)	8.047, 1.225 (46)
Architecture & US	7.886, 1.201 (21)	7.302, 2.043 (21)	8.226, 1.240 (21)
Business	7.648, 1.067 (29)	7.605, 1.696 (28)	8.207, 1.311 (29)
Engineering	7.590, 1.215 (63)	7.936, 1.725 (63)	8.288, 1.100 (62)
Liberal Arts & HS	8.397, 1.175 (144)	7.135, 2.049 (141)	8.492, 1.108 (143)
Natural Resources	7.859, 1.371 (15)	7.731, 1.646 (15)	8.287, 1.011 (15)
Science	7.687, 1.288 (65)	7.113, 1.730 (65)	8.332, 1.247 (64)
Vet. Med.	6.575, 1.414 (5)	7.787, 2.194 (5)	7.900, 2.277 (5)

Note. Means, then standard deviations, are listed first. The number of respondents is in parentheses.

Table L9

Means, Standard Deviations, and Ns for Self-efficacy Types Stratified by Computer Skill

Skill-level	CTSE	TTSE	GSE
Novice	0.000, 0.000 (0)	0.000, 0.000 (0)	0.000, 0.000 (0)
Below Average	8.337, 0.959 (10)	3.950, 1.571 (10)	8.736, 0.720 (10)
Average	7.781, 1.298 (126)	6.143, 1.769 (125)	8.173, 1.296 (126)
Above Average	8.018, 1.237 (189)	7.723, 1.505 (187)	8.343, 1.129 (188)
Expert	7.878, 1.344 (66)	9.031, 0.946 (65)	8.484, 1.188 (64)

Note. Means, then standard deviations, are listed first. The number of respondents is in parentheses.

Table L10

Means, Standard Deviations, and Ns for Self-efficacy Types Stratified by Computer Preference

Computer Type	CTSE	TTSE	GSE
Windows	7.835, 1.257 (240)	7.346, 1.887 (238)	8.286, 1.157 (237)
Macintosh	8.099, 1.302 (129)	7.321, 1.846 (128)	8.363, 1.261 (129)
Linux	7.446, 0.936 (9)	7.640, 1.589 (9)	8.736, 0.777 (9)

Note. Means, then standard deviations, are listed first. The number of respondents is in parentheses.

Table L11

Means, Standard Deviations, and Ns for Self-efficacy Types Stratified by TLC Workshop Attendance

Number Attended	CTSE	TTSE	GSE
0	7.832, 1.314 (167)	7.312, 2.017 (164)	8.289, 1.270 (165)
1	7.948, 1.128 (51)	7.321, 1.867 (51)	8.322, 1.189 (51)
2	7.901, 1.194 (53)	7.325, 1.633 (53)	8.376, 1.012 (53)
3	8.143, 1.189 (38)	7.652, 1.945 (38)	8.341, 1.193 (37)
4	8.145, 1.024 (18)	7.891, 1.494 (18)	8.407, 1.140 (18)
5	8.169, 0.943 (18)	6.459, 2.242 (18)	8.428, 0.934 (18)
6	7.991, 1.679 (15)	7.213, 1.687 (14)	8.204, 0.993 (15)
7	7.564, 1.569 (6)	7.867, 2.123 (6)	7.583, 1.411 (6)
8	7.213, 1.495 (5)	6.471, 2.038 (5)	7.400, 1.784 (5)
9	9.341, 0.000 (1)	7.500, 0.000 (1)	7.500, 0.000 (1)
10	7.725, 1.305 (6)	7.256, 2.477 (6)	8.750, 0.829 (6)
11	10.000, 0.000 (1)	8.444, 0.000 (1)	9.750, 0.000 (1)
12	8.591, 1.479 (2)	6.650, 0.212 (2)	8.750, 1.768 (2)

Note. Means, then standard deviations, are listed first. The number of respondents is in parentheses.

Table L12

Means, Standard Deviations, and Ns for Self-efficacy Types Stratified by TTR Workshop Attendance

Number Attended	CTSE	TTSE	GSE
0	8.070, 1.141 (104)	7.338, 2.106 (103)	8.383, 1.243 (103)
1	7.693, 1.341 (76)	7.061, 1.968 (76)	8.262, 1.268 (76)
2	7.848, 1.205 (52)	7.781, 1.528 (52)	8.205, 1.205 (52)
3	8.430, 1.137 (39)	7.181, 1.716 (38)	8.816, 0.908 (38)
4	8.272, 1.013 (22)	6.864, 1.875 (22)	8.232, 1.211 (22)
5	7.698, 0.913 (19)	6.959, 1.896 (19)	7.691, 0.950 (19)
6	7.069, 1.501 (24)	7.356, 1.899 (23)	8.199, 1.166 (24)
7	8.370, 1.097 (10)	7.744, 2.332 (9)	8.806, 1.039 (9)
8	7.798, 1.448 (14)	7.679, 1.806 (14)	8.036, 1.017 (14)
9	7.892, 0.727 (4)	7.025, 0.854 (4)	8.094, 1.280 (4)
10	8.148, 1.706 (13)	7.449, 2.291 (13)	8.096, 1.392 (13)
11	9.333, 0.000 (1)	7.100, 0.000 (1)	9.875, 0.000 (1)
12	7.760, 1.129 (4)	7.400, 0.392 (4)	8.094, 0.514 (4)
13	8.046, 0.000 (1)	9.600, 0.000 (1)	9.250, 0.000 (1)

Note. Means, then standard deviations, are listed first. The number of respondents is in parentheses.

Table L13

Means, Standard Deviations, and Ns for Self-efficacy Types Stratified by GTA Preparation / College Course Attendance

Number Attended	CTSE	TTSE	GSE
0	7.934, 1.301 (314)	7.344, 1.973 (311)	8.341, 1.184 (312)
1	8.027, 1.126 (53)	7.103, 1.652 (52)	8.325, 1.353 (52)
2	7.772, 0.966 (12)	7.658, 1.313 (12)	8.158, 0.571 (12)
3	5.727, 0.064 (2)	8.900, 0.566 (2)	7.313, 0.442 (2)
4	7.400, 1.375 (5)	6.660, 1.521 (5)	7.600, 1.088 (5)

Note. Means, then standard deviations, are listed first. The number of respondents is in parentheses.

Appendix M

This appendix serves as a supplement to the results section of research question one in chapter four. It contains statistical overviews and narratives for the demographic variables for which non-significance differences were found for all three types of self-efficacy (college teaching, teaching with technology and general).

Degree

In consideration of the highest degree held, there were no significant differences between respondents with bachelors, masters, and doctorate degrees with regard to college teaching self-efficacy, $F(2,383) = 0.004$, $p>.05$, teaching with technology self-efficacy, $F(2,379) = 0.913$, $p>.05$, or general self-efficacy $F(2,380) = 0.545$, $p>.05$. Table L3 provides the means and standard deviations for all three types of self-efficacy stratified by highest degree held.

Class Size

It was found that there were no significant differences in college teaching self-efficacy based upon the size of classes taught by respondents, $F(5,385) = 1.919$, $p>.05$. This was also true for teaching with technology self-efficacy, $F(5,381) = 2.135$, $p>.05$, as well as general self-efficacy, $F(5,382) = 1.386$, $p>.05$. Table L6 provides the means and standard deviations for all three types of self-efficacy stratified by class size.

Computer Preference

Regarding computer preference, it was found that no significant difference exists between mean college teaching self-efficacy scores for Windows, Macintosh, and Linux users, $F(2, 375) = 2.460$, $p>.05$. This is also true for teaching with technology self-efficacy, $F(2,372) = 0.123$, $p>.05$, and general self-efficacy, $F(2, 372) = 0.731$, p>.05.

Table L10 provides the means and standard deviations for all three types of self-efficacy stratified by computer preference.

Faculty Development Experiences

There are no significant differences between those who attended few or many pedagogy training, lectures, and/or workshops (TLC) in the realms of college teaching self-efficacy, $F(12,368) = 0.848$, $p>.05$, teaching with technology self-efficacy, $F(12,364) = 0.702$, $p>.05$, nor general self-efficacy, $F(12,365) = 0.733$, $p>.05$. Table L11 provides the means and standard deviations for all three types of self-efficacy stratified by TLC workshop attendance.

Similarly, no significant difference was found between those who attended few or many sessions in teaching and technology training, lectures, and/or workshops (TTR) in the realms of college teaching self-efficacy, $F(13,369) = 2.168$, $p>.05$, teaching with technology self-efficacy, $F(13,365) = 0.696$, $p>.05$, nor general self-efficacy, $F(13,366) = 1.446$, $p>.05$. Table L12 provides the means and standard deviations for all three types of self-efficacy stratified by TTR workshop attendance.

Regarding attendance in GTA preparation / college course on teaching training workshops, it was found that in relation to college teaching self-efficacy, there was no significant difference between those that attended few or many of these, $F(4,368) = 1.791$, $p>.05$. This is also true for teaching with technology self-efficacy, $F(4,364) = 0.823$, $p>.05$, and general self-efficacy, $F(4,365) = 0.853$, $p>.05$. Table L13 provides the means and standard deviations for all three types of self-efficacy stratified by GTA preparation / college course attendance.

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EDUCATION

Ph.D., Instructional Design and Technology May 2007
Virginia Polytechnic Institute and State University, Blacksburg, VA
Dissertation: "Self-efficacy, the Innovation-Decision Process, and Faculty in Higher Education: Implications for Faculty Development"

M.A., English May 1995
Virginia Polytechnic Institute and State University, Blacksburg, VA

B.A., English May 1993
Virginia Polytechnic Institute and State University, Blacksburg, VA

B.S., Statistics May 1992
Virginia Polytechnic Institute and State University, Blacksburg, VA

CURRENT POSITION

Virginia Polytechnic Institute and State University (Virginia Tech)
Blacksburg, Virginia **October 1997-present**

Assistant Director
Educational Technologies 2006-present
- Manage the diffusion and adoption of strategic emerging technologies and programs
- Assist in providing vision, planning, and direction for department
- Act as translator and conduit between faculty and technical staff
- Facilitate community development around strategic initiatives
- Manage external resources and suppliers, while coordinating staff resources
- Participate in the development and management of departmental budget
- Includes duties described in the three positions listed below within Educational Technologies and the Faculty Development Institute

Coordinator of Instruction / Lecturer
Faculty Development Institute (FDI) 2003-present
- Design and evaluate ongoing, year-long curriculum which includes new faculty training, 3-day summer institutes, and academic year workshops
- Coordinate and participate in the development of instructional materials for FDI workshops and summer institutes
- Perform ongoing, university-wide needs assessments to ensure that programming matches institution's needs and goals
- Foster collaborative relationships with departments and colleges across campus

Coordinator of Instruction / Lecturer *(continued from previous page)*
- Develop relationships with vendors to procure training for faculty and graduate students for high-end, research technologies
- Identify emerging technologies and new pedagogical approaches and develop plans for effective diffusion and training
- Hire and manage all facilitators, instructors, assistants, content developers, peer mentors, and interns for all FDI programming as well as grant projects
- Develop and implement inventive marketing strategies for FDI programming
- Manage design/development of FDI web site and online training materials
- Provide consultation, both one-on-one and in small groups, with instructional faculty concerning technological and pedagogical topics
- Administer incentives program encouraging faculty participation in programming

Manager, Special Projects
Educational Technologies 2005-present
- Develop and implement project plans regarding the diffusion of specific emerging technologies and programs at Virginia Tech
- Identify faculty, organize, and facilitate the progress of learning communities as they investigate, develop, and apply emerging technologies
- Ensure access to resources needed to support faculty pedagogical success
- Organize and chair committees in an effort to encourage broad ownership and interest in initiatives
- Develop instruments and collect data regarding faculty and student perceptions of new instructional methods and technologies
- Act as conduit/translator between faculty and technical staff
- Current projects include Virginia Tech's Open Source ePortfolio Initiative (OSP 2.x), iTunes U, and the development of a professional development initiative for staff

Curriculum Developer / Facilitator / Instructor
Faculty Development Institute (FDI) 1998-present
- Design, develop, and deliver a wide variety of workshops on both pedagogical and technical topics
- Function as team leader for the development and delivery of the content for 3-day summer institute sessions
- Provide consulting for faculty on a broad range of pedagogical and technological topics

Project Manager/Senior Instructional Designer
Digital History Reader Project (NEH Funded) 2003-2006
- Provide instructional design and instructional technology leadership and consulting for members of the project team
- Identify and evaluate technologies that will enable students to achieve desired instructional outcomes
- Identify and evaluate technologies that will provide course instructors with accurate and manageable forms of assessment
- Identify and establish collaborative relationships with university agencies that can contribute server space, expertise, and other services and resources

Project Manager/Senior Instructional Designer *(continued from previous page)*
- Hire, supervise, and assign work for graduate student production assistants
- Manage, coordinate, and facilitate instructional materials production
- Document progress of grant and provide content for scheduled reports to NEH
- Suggest and develop training opportunities for GAs and content specialists
- Construct formative and summative evaluation mechanisms

Instructor
Graduate Education Development Initiative Spring 2004
- Developed and delivered new graduate course (GRAD 5984: "Critically-Engaged Teaching with Advanced Technologies") for the emerging Preparing Future Professoriate program at Virginia Tech

Instructional Design and Technology Specialist
Department of Foreign Languages and Literatures
1997-2005
- Consulted and collaborated with faculty to provide guidance through the instructional design process for distance learning projects
- Manage department's Student Language Lab & Faculty Lab
- Review software/hardware and submit purchasing recommendations
- Routinely assist faculty with general technical support
- Complete technology surveys and reports with competing deadlines
- Assist in the analysis, design, development, and implementation of online course materials on all levels, including web design, development; image manipulation; course management support; streaming video production; etc.
- Provide outreach programs and workshops for K-12 teachers in surrounding area

Senior Technology Consultant and Organizer of Special Technology Sessions
South Atlantic Modern Language Association 2004 Convention 2003-2004
- Chaired the proposal review process for special sessions discussing applications of technology (13 sessions in all)
- Coordinated all of the technological details for the convention
- Hired student employees and coordinated details with SAMLA and conference hotel

Manager, ATM Video Distance Learning Classroom
Dean's Staff Member
College of Arts and Sciences
1997-2000
- Managed the College of Arts and Sciences' ATM Video Distance Learning (V-TEL) Classroom and advised faculty teaching in this environment
- Provided training and guidance for those using this technology
- Liaison between university agencies and groups while acting as an advocate for the use of instructional technology for instruction, research, and outreach
- Spearheaded the College of Arts & Sciences' Technology Competencies Initiative
- Delivered presentations to College of Arts and Sciences' groups and visitors

PREVIOUS POSITIONS

Computer Programs Director, *Academic Programs*
The New School of Northern Virginia, Fairfax, VA April 1996-September 1997

- Provided leadership for information and instructional technologies
- Coordinated strategic and operational planning for all technology-based programs
- Advised senior leadership on technologies that would improve instructional and administrative activities
- Acted as an advocate for the implementation and usage of educational technologies
- Conceived, planned, developed and integrated a progressive Computer Science Curriculum including the usage of technology in most disciplines
- Designed and taught a variety of courses (see Courses Taught)
- Developed tutorials and manuals and delivered presentations training both students and faculty to use computers, the network & a variety of A/V equipment
- Designed and taught in-service seminars showing educators how to implement computers, the internet, and other multimedia tools into their curriculum
- Managed all network administrator duties including the maintenance of the school's in-house e-mail server, web server, and multi-platform ethernet LAN
- Conceived, drafted, coded, and updated the school's web pages
- Previewed, assessed, purchased, upgraded, and configured all computer hardware, software, A/V equipment, e-mail and web servers, while working within a budget
- Supervised networked multi-platform computer lab while assisting students faculty
- Hired and supervised lab assistants
- Installed, maintained and scheduled use of all multimedia equipment (including computers, A/V equipment, and computer lab)
- Diagnosed and repaired hardware, software, TCP/IP, and LAN problems
- Designed and implemented a multi-platform ethernet LAN for the entire school
- Researched, purchased, and installed internet gateway, router, and network hubs

Director, *Summer Computer Camp*
The New School of Northern Virginia, Fairfax, VA Summers 1996 and 1997

- Designed and taught all Summer Computer Camp Courses (Computer/Video Production, Computer Animation, Computer Literacy and HTML Courses)
- Planned and implemented all computer camp activities
- Designed and wrote brochures for Summer Camp and managed camp promotion
- Developed and coded web pages for the marketing of the camp on the internet
- Hired and supervised camp assistants and student assistants

Administrator / Technical Writer, *Quality Control*
VTLS Inc., Blacksburg, VA June 1995-April 1996
- Coordinated and scheduled all quality control and testing activities
- Collaborated and participated in the testing of software
- Worked with several libraries for the purpose of software (beta) testing activities
- Managed the information flow between developers, reviewers and testers
- Interviewed prospective quality control employees
- Ensured all documentation completely and accurately reflected the capabilities of the software being examined and revised as needed
- Designed and wrote marketing materials, brochures, news releases, and web pages

Graduate Teaching Assistant, *English Department*
VPI & SU, Blacksburg, VA, August 1994 - May 1995
- Taught Freshman Composition in the Computer Integrated Classroom utilizing Daedalus, the internet, and multimedia presentation tools
- Designed all class activities, assignments and syllabi
- Developed peer editing guidelines and training workshops
- Critiqued, graded, and commented extensively on student writing

GRANTS

- **National Endowment for the Humanities (NEH) Grant – Digital History Reader Project** (project manager / senior instructional designer) – see above for details
- **Funding for Improving Post-secondary Education (FIPSE - U.S. Department of Education) Grant - CREOLE Online Course Development Project** (development coordinator) - coordinate production, track content specialists, edit content, transform content into web format, design/create graphics, train beta-testers, develop evaluation strategies, and serve on steering committee (Fall 2002 – 2004)
- **United States Department of Education Title VI Grant** (consultant) – provided technical expertise as the grant was written. (Fall 2001 – present)
- **College of Arts & Sciences Millenium Grant** (Co-PI) - provided instructional design & technology consulting & managed students workers (Fall 1999 – Spring 2000)
- **IDDL Fellowship** (Co-PI) - provided technology portions of grant (Summer 1999)
- **Foreign Languages ReachOut Grant** (Co-PI) - provided instructional design and technology consulting (Spring 1998)
- **MIFLC98 Conference Grant** (participant) - provided technology support for regional conference, delivered conference paper, and led panel (Spring 1998 – Fall 1998)
- **CyberSchool Grant** (participant) - provided instructional design and technology guidance and support (Summer 1998)
- **Center for Innovation in Learning Grant** (participant) - provided instructional design and technology consulting (Fall 1997 - Fall 1998)

COURSES TAUGHT

Courses Taught at Virginia Tech:
- GRAD 5984: Critically-Engaged Teaching with Advanced Technologies
- EDCI 6134: Instructional Design for Distance Education (team taught with Dr. Barbara Lockee)
- English 1105: Critical Literacy
- English 1106: The Writing Project
- English 4784: Senior Seminar (team taught with Dr. Anthony Colaianne)

Courses Taught at the New School of Northern Virginia:
- Hypertext: Classical and Biblical Backgrounds to Literature
- Twentieth Century Poetry
- Creative Writing: Poetry
- Critical Literacy: A Consideration of Generation X
- The History of Popular Music
- Film Production: Writing & Directing Your Own Film
- Computer Animation and Video Production

CONFERENCES and MEETINGS

Attendance Only:
- Educause, Dallas, TX, October 2006.
- Learning Technology Consortium Meeting, Blacksburg, VA. April 2006.
- Fourth SAKAI Conference, with OSP. Austin, TX. December 2005.
- Learning Technology Consortium Meeting, Athens, GA. April 2005.
- Learning 2000 Conference: Reassessing the Virtual University. Roanoke, Virginia. September 2000.
- Heinle and Heinle National Video Conference: "The Coming of Age of the Profession." October 1999.
- Instructional Technology Conference (IT99): The New Millennium. Sponsored by Virginia Tech, Blacksburg, Virginia. March 1999.
- VCCS/VT: "Transfer Conference for Faculty Dialogue." December 1997.

Conference Presentations:

Watson, C.E. (2006, December). *Preparing faculty to use OSP: Facilitating ePortfolio pedagogy development.* Paper presented at sixth Sakai Conference with OSP, Atlanta, GA.

Watson, C.E. (2006, October). *ePortfolio in higher education: Student assessment and beyond.* Paper presented at the annual conference of the International Society for Exploring Teaching and Learning, Palm Springs, CA.

Watson, C.E. (2006, June). *Faculty development at Virginia Tech: A case study.* Paper presented at EduComm 2006, Orlando, FL.

Watson, C.E., Moore, J. (2005, October). *Keeping faculty development relevant: Leading and responding to institutional change.* Paper presented at Educause 2005, Orlando FL.

Conference Presentations *(continued from previous page)*:

Clark, C.G., Watson, C.E., de Vry, J. (2005, October). *How course management systems can improve learning: Three case studies.* Paper presented at the annual conference of the Association for Educational Communications and Technology, Orlando, FL.

Ewing, T., Lehr, J., Nelson, A., Watson, C.E., Hicks, D., (2005, March). *How can educational technology improve content knowledge and classroom pedagogy? Teaching history and preparing teachers with the Digital History Reader.* Paper presented at the annual international conference of the Society for Information Technology and Teacher Education, Phoenix, AZ.

Watson, C.E., Schwartz, E.E. (2004, November). *Blended instruction: Taking the best of both worlds.* Paper presented at the annual conference of the South Atlantic Modern Language Association, Roanoke, VA.

Depauw, K., Fowler, S., Watson, C.E. (2004, November). *Changing the academy: Faculty and graduate student development at Virginia Tech*. Paper presented at the annual conference of the South Atlantic Modern Language Association, Roanoke, VA.

Laudato, N., Moore, J., Watson, C.E. (2004, October). *Faculty instructional labs: Now that you've built them, are they coming?* Paper presented at Educause 2004, Denver, CO.

Ewing, T., Watson, C.E., Stephens, R., Hicks, D., (2004, October). *The digital history reader: Enhancing learning and understanding in world and US history.* Paper presented at the annual conference of the International Society for Exploring Teaching and Learning, Baltimore, MD

Laudato, N., Watson, C.E., Moore, J. (2004, June). *Faculty instructional labs: Now that you've Built them, are they coming?* Paper presented at the New Media Center Summer Conference, Vancouver, BC.

Watson, C.E. (2001, July). *Information literacy: Helping your students evaluate internet resources*. Paper presented at the annual Classics Summer Vergil Institute for Latin Teachers, Gainesville, FL.

Watson, C.E. (1998, October). *Chat rooms, online materials and more: Enhancing your curriculum with the internet*. Paper presented at the annual Mountain Interstate Foreign Language Conference, Blacksburg, VA.

Watson, C.E. (1995, November). *Poeticism and postmodernity: The state of the art in the 1990's*. Paper presented at the annual English Graduate Student Conference, Blacksburg, Virginia.

PUBLICATIONS / HONORS / AFFILIATIONS

- Won Virginia Tech's Xcaliber Award for Exemplary Teaching with Technology Project – Digital History Reader (Spring 2007)
- Selected as "Outstanding Graduate Student of the Year" in IDT Program (Spring 2007)
- Received the "Systemic Progress in Teaching and Learning" Award from Educause (October 2005)
- Elected Vice-President of Virginia Tech's Instructional Design and Technology Student Association (Fall 2005)
- Member of the International Society for Exploring Teaching and Learning (ISTEL) (Fall 2004 – present)
- Member of the South Atlantic Modern Language Association (SAMLA) (Fall 2004 – present)
- Member of Educause (Spring 2004 – present)
- Member of the Professional and Organizational Development Network (POD Network) (Spring 2004 – present)
- Member of the Association for Educational Communications and Technology (AECT) (Fall 2003 – present)
- Co-authored book chapter entitled "Developing Interactive Web-based Courses" for online, FIPSE-Funded project called CREOLE (Spring 2004)
- Member of the Virginia Society for Technology in Education (VSTE) (1998-present)
- Earned highest teaching performance evaluations as GTA (Spring 1995)
- Received merit-based tuition waver at VA Tech (1994-1995)
- Awarded merit-based Research Assistantship (Summer 1994)
- Winner in both the 1993 and 1994 VA Tech Poetry & Fiction contests
- Published on three occasions in VA Tech's literary magazine
- Awarded Knobler Essay Prize – given yearly to the Virginia Tech student who writes the best critical essay (Spring 1993)