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Technology adoption into teaching and learning by mainstream university faculty: a mixed methodology study revealing the 'how, when, why, and why not'

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TECHNOLOGY ADOPTION INTO TEACHING AND LEARNING
BY MAINSTREAM UNIVERSITY FACULTY: A MIXED METHODOLOGY STUDY
REVEALING THE 'HOW, WHEN, WHY, AND WHY NOT'

A Dissertation

Submitted to the Graduate Faculty of the
Louisiana State University and
Agricultural and Mechanical College
in partial fulfillment of the
requirements for the degree of
Doctor of Philosophy

in

The Department of Educational Leadership, Research, and Counseling

by

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ABSTRACT

The field of educational technology has been and continues to be an influential component within the vast array of educational strategies, pedagogies, plans, and processes designed to enhance student learning. Faculties are realizing the relevance and potential of educational technologies in their teaching and professional and personal growth. However, the distance between envisioning technological use and actual implementation is often a long, winding road for many educators.

University faculty members are in the midst of a strong emphasis by various stakeholders to travel that road and to travel it with speed and accuracy. The mainstream members of tertiary level faculties encounter both obstacles and support along the road in varying degrees and proportions. The purpose of this exploratory mixed methodology study was designed to reveal the voice of those often hesitant travelers and to determine the how, when, why, and why not of their choosing to integrate technology into their teaching and learning. Data were collected through a survey administered to faculty from three academic colleges and interviews of selected survey respondents.

Data were analyzed descriptively, by way of path analysis, and with the constant comparative method. This study attempted to provide insight into the processes of the adoption of innovation by mainstream faculty members, thus resulting in a Technology Integration Process Model. The results suggest that faculty members recognize potential benefits of technology in teaching and learning and that peer interactions and collegiality are significant in helping them learn new innovations and strategies. This fundamental knowledge is expected to inform the design of professional development relevant to those continuing on the journey and those who have not yet chosen to travel.

CHAPTER 1

INTRODUCTION

A group of departmental faculty members gather voluntarily for a lunch-time seminar where faculty members will share their current research. The setting is informal and relaxed, with a sense of true collegiality present. The faculty member presents her recent study's findings using a technology-enhanced format. Other faculty members pose questions concerning the research and express interest in the findings. The conversation progresses to related topics and breaks down into small-group discussions. One faculty member, who is a self-proclaimed 'non-techie', probes further into the presenter's use of Blackboard course management tools in her classes. His desire for knowledge for his own class use prompts a request for extended help in setting up and using Blackboard as a course component.

What inspires others to adopt new strategies and innovations? What collegial climate is conducive to exacting individual change? Professional development regarding the skills and strategies needed for effective technology integration in the classroom has evolved through various levels, modes, and methods in the educational arena. As computers were placed in K-12 classrooms in the early 1980s, classroom teachers began to be faced with the dilemma of how best to use these machines with their students.

The years marched forward and school administrators searched for evidence that their teachers were using the computers effectively in their classrooms to produce computer-literate students (Orwig, 1994). A surge of interest gathered momentum in ensuring that pre-service teachers were proficient and skilled in integrating technology into their teaching prior to entering full-time service (Schrum, 1999). To achieve this means, leaders in teacher preparation programs at the university level were encouraged through national standards and accreditation-based emphases (ISTE, 2002; NCATE, 2002) to create curricula designed to utilize technology as an integral part of teaching. This recent upward directionality of responsibility has now encompassed university faculty members

in both teacher preparation programs and discipline-specific content areas as ‘teachers of teachers’.

Within the realm of tertiary-level education, the acquisition, implementation, and institutionalization of the skills and strategies necessary for the effective and integral use of instructional technologies to enhance student achievement are garnering attention.

University faculty members are realizing their influence as models on those who are selecting education as their chosen profession. This modeling assists in increasing the preservice teachers’ confidence levels in using technology while learning teaching practices (Pope, Hare, & Howard, 2002). It has been suggested that teacher preparation should focus on specific types of technology use by preservice teachers, such as the practices for using diverse technologies to support and enhance various aspects of teaching and learning (Russell, Bebell, O’Dwyer, & O’Connor, 2003).

In order for university faculty to effectively model and use instructional technologies, appropriate venues for professional development must be made available. The complex structure, culture, and historical autonomy of a university provide a different context for technology-integration professional development than that prescribed for K-12 classroom teachers and administrators. A little more than a decade ago, Schwieso (1993) noted that little research had been done on the use of information technology by academics in higher education. Subsequent studies have focused primarily upon the skills required to use technology, the barriers and concerns encountered in using technology (Adams, 2002; Neal, 1998), and the training required to either put courses on the Web or to develop skills in teaching online (Crawford, 2003; White & Myers, 2001).

Studies targeting faculty use of technology in higher education have largely focused upon attitudes, beliefs, self-efficacy, and a variety of other social cognitive factors (Dusick, 1998; Groves & Zemel, 2000; Mitra, Steffensmeier, Lenzmeier, & Massoni, 1999; Spotts, 1999). A variety of methodologies have been utilized within the studies and generally the results are stated similarly.

There are many factors that influence the use of technology and the teaching with technology; however, the majority of faculty studied comprises those who are considered innovators and early adopters. Traditionally described levels of technology adopter categories set forth by E.M. Rogers (1995) are innovators, early adopters, early majority, late majority, and laggards. These groups represent faculty adopters along a continuum typically represented by the bell-shaped curve.

Holland (2001) stresses that when planning faculty development opportunities, categorical groups and the developmental levels through which they pass while assimilating the knowledge and skills required for effective technology integration must be taken into consideration and supported in order for the learning opportunity to be optimized for all participants. Holland's study identifies the developmental levels as a continuum of non-readiness, survival, mastery, impact, and innovation.

Celsi and Wolfinbarger (2002) suggest that adoption of innovation patterns by university faculty moves through three waves or stages: (1) technology as a support function not significantly affecting teaching, (2) technology used in teaching but with little significant classroom change, and (3) technology use results in fundamental change in classroom structure and behaviors. They indicate that faculty adopter categories are early adopters, mirrorers, and detractors.

Creating a simplified model of Rogers' adopter classification categories, Hagner and Schneebeck (2001) describe four characteristic groups of faculty members regarding their motivations in using technology in teaching. The entrepreneurs, risk averse, reward seekers, and reluctants are the four groups they gleaned from over 240 faculty interviews at a northeastern university. The risk averse group exhibiting characteristics of lacking technical expertise, fearing new teaching environments, requiring significant levels of instructional support, hesitating to engage in self-examination, and requiring demonstrations of effectiveness from their peers are representative of the mainstream faculty group often neglected as universities set up "their support structures on the basis of the characteristics of the entrepreneurs" (Hagner & Schneebeck, 2001, p. 6).

Common to the majority of research explorations, Pierson (2001), Jacobsen (1998a), and Ebersole and Vorndam (2003) studied experts' or exemplars' characteristics, aptitudes, and leadership skills in adoption with the underlying assumption that these groups are seen as models for the majority and the way to lead the masses to technology integration. There is a need for studies involving the mainstream (Baldwin, 1998; Adams, 2002), thus, documenting their story of adoption of innovations. Lacking in the research is the voice of that majority comprised of Rogers' adopter categories - Early Majority, Late Majority, and Laggards.

"Adopter categories are the classification of members of a social system on the basis of innovativeness, the degree to which an individual or other unit of adoption is relatively earlier in adopting new ideas than other members of a system." (Rogers 1995, p. 279). The continuum of innovativeness can be partitioned into five adopter categories on the basis of two characteristics of a normal distributed bell-shaped curve, the mean and the

standard deviation. As described by Rogers (1995), adopter distributions tend to follow an S-shaped curve over time and to approach normality. The S-shaped curve represents the cumulative number of adopters. This distribution rises slowly; then, accelerates to a maximum until half have adopted. It continues increasing slowly as fewer and fewer adopt. Positive change and expert teaching occur across all categories, but there is little documented evidence of how and why the mainstream members of the population choose to adopt innovations, however slowly, as represented on this S-curve continuum of adoption.

According to Rogers (2002) there is a common belief among many technologists that the diffusion of technologies will diffuse spontaneously without the benefit of technology transfer activities. When this does not occur, it is often thought to be the fault of the receptors. This perpetuation of stereotypes of those who are not eager or receptive to innovations can become a self-fulfilling prophecy (Rogers, 1995). These receptors are not contacted directly by change agents on the basis of their stereotypic image and the feeling that “such contact will be unfruitful in leading to adoption. The eventual result is that without the information inputs and other assistance from the change agents the later adopters are even less likely to adopt. Thus, the individual-blame image of the later adopters fulfills itself.” (Rogers, 1995, p. 118).

In response to these perceptions, Jacobsen (1998b) indicates that the challenge is not to blame or attempt to fix faculty attitudes, but rather to design educational systems that reflect faculty social systems, communication channels, and patterns of diffusion. She notes further that, “A different support infrastructure is clearly needed for mainstream faculty than that which sufficed for early adopters of technology” (p. 7).

Statement of the Problem

There is a current thrust for universities to discover the key to successful professional development for faculty involving effective teaching that incorporates technology as an integral tool. Despite the growing number of studies on diverse areas of this topic, there continues to be a gap in our current knowledge and insight as to the factors and processes that mainstream university faculty members utilize when choosing to adopt innovations, the collegial climate best suited for inducing change, and the benefits gained by the faculty and their students as a result of a change in teaching behaviors. There is a need for a more complete understanding of how change occurs among mainstream faculty as this group encompasses the majority of the faculty population that is involved in post-secondary teaching.

Willis, Thompson, and Sadera (1999) recognize the need for more detailed case studies on the process of change and diffusion efforts. Professional development and support for technology designed to target the early adopters and innovators, thus accelerating the adoption process, often do not recognize the mainstream faculty (as cited in Woodell & Garofoli, 2003). There is a need to balance the previous research focusing solely on those who are considered innovators or early adopters. This study attempts to understand the adoption and implementation processes experienced by mainstream faculty members when engaged in pedagogical change. This may serve as a means to inform professional development design decisions that could influence university faculty development.

Purpose of the Study

Teaching and learning at the post-secondary level is undergoing a current revitalization (Hativa, Barak, & Simhi, 2001). The importance of effective teaching toward student learning styles, multiple intelligences, modalities, and motivational levels is creating a focus upon university faculties' innovative approaches and strategies. The purpose of this study was to accentuate the positive steps or strides of faculty innovation adoption and to provide insight into the rich detail involved in the processes of how a faculty member seeks change, the importance of the communities of practice in which he/she is a member, and the benefits derived by both faculty and students from the adoption of the technological innovation. Similar to Ely (1999), this study intended to “tease out reasons for successful efforts” (p. 24). Holloway (1996) provides a succinct perspective of productive research salient to this study:

If we are to understand how technology is diffused and what kind of adaptation is needed, we must understand the context of technology and education in the larger culture. The perceptions of the teachers, students, and other stakeholders in the process, their real reasons for use and nonuse, require research that is reflective, grounded, and open. Studies that focus on the social context of technology for decision makers, teachers, publics, and students are the most productive new perspectives for diffusion and adoption research. (p. 1130)

The focus of this study was to explore the factors of institutional support, institutional resources, and peer support as related to the processes of instructional design and delivery in which mainstream faculty engage in their technology integration efforts.

An additional focus was to discover the relationships between the factors and processes, and subsequently their perceived impact on student learning processes and performance.

Specifically, the objectives of the study were: 1) to use quantitative survey data in identifying patterns of adoption and usage of technology in teaching and learning, 2) to use qualitative interview data to seek an in-depth perspective on understanding the interplay of community of practice and institutional support and their roles in impacting faculty motivation, 3) to understand the extent that mainstream faculty members use technology in various processes of teaching, 4) to develop insight as to the tangible and perceived benefits by faculty in adopting technology innovation in their teaching, and 5) to develop a model of mainstream faculty technology integration process related to higher education faculty members.

Significance of the Study

This study was expected to delve more deeply into technology integration at the university level rather than simply revealing characteristics of the mainstream faculty. Included was a significant emphasis on communities of practice and the roles of support mechanisms needed for faculty to adopt innovations. Rogers (2003) issues a call for research on “network influences on individual’s innovativeness” (p.297). This study was expected to illustrate the adoption of innovations by mainstream faculty as an evolutionary process involving varied factors of influence.

The dearth of literature focusing upon mainstream faculty members’ use of technology was addressed with this study. It was expected that this study will assist in filling that gap in the literature.

Additionally, this study of the technology integration process of mainstream faculty was expected to inform the development of a technology integration process model. The model is unique in its emphasis on the support mechanisms necessary to first motivate faculty to adopt technology. Peer Support and Institutional Support are viewed as key components in the process. Few models in the literature reviewed later in this chapter reflect a university faculty perspective or the inclusion of peer support.

The model was expected to inform the design of professional development opportunities stressing communities of practice and the roles of information sources or support channels in helping mainstream faculty members in their process of technology innovation adoption. Helping faculty become more interdependent and mutually supportive in the integration of technology is considered to be a “major professional development challenge for faculty developers and academic institutions” (Sherer, Shea, and Kristensen, 2003, p. 184). This study was expected to enrich the line of inquiry concerning developing and sustaining effective opportunities for professional development for faculty.

Contributions of this study in the areas of faculty use of technology and their perceived impact on student learning were anticipated. Knowledge of usage patterns and perceived benefits by faculty was expected through the data generated and analyzed in this study.

Limitations of the Study

The mixed methodology chosen for this study presented differing limitations. The quantitative analysis of survey results provided inferred relationships that should not be interpreted as causal. Qualitative methods were addressed in a particular fashion to

eliminate threats to credibility and validity. Both methodologies were used in this study to complement the findings of the other and to provide triangulated data necessary to aid in checking the validity of the interview findings (Gall, Borg, & Gall, 1996).

The chosen sampling strategy presented limitations through the focused sampling from a single research-intensive university located in a particular geographical region and from specific academic colleges within that setting. This limited the generalizability or transferability of results and implications to other tertiary-level institutions or faculty members from other colleges or departments in other geographical regions. The interview methodology chosen as the segment of the qualitative component of this study used as its strength the small sample size (Patton, 2002) in that rich descriptive, explanatory information was acquired and analyzed. This, however, limited the transferability of the study to contexts other than the one specific to the study or to larger populations.

Definition of Terms and Constructs

Descriptive definitions of pertinent terms related to this study are as follows:

Change agent - An individual who promotes and institutes change

Collegial climate – An atmosphere conducive to shared learning and decision-making

Communities of Learners -- A community that makes learning a central part of its activity; often synonymous with ‘communities of practice’

Communities of Practice -- Groups of people who share a domain of knowledge, a concern, a set of problems, or a passion about a topic, and who extend their knowledge in this shared area by interacting on an ongoing basis

Educational technology – The design, development, implementation, evaluation and management of instructional processes and resources intended to improve learning and performance

Effective teaching – Teaching pedagogies that result in observable student achievement

Effective technology integration – The use of technology in education as an integral tool for the purpose of enhancing student achievement

Endogenous variable - A variable in path analysis where it is assumed that its variance is explained by the exogenous variables included in the path model

Exogenous variable - A variable in path analysis where it is assumed that its variance is explained by other variables outside the causal model under consideration

Information technology – Technologies used for communication exchange

Innovation – An idea, practice, or object that is perceived as new by an individual

Mainstream faculty members -- University faculty members representative of the central distribution of the innovation adopter categories as defined by Rogers (1962)

Social networks – Communication networks between individuals

Systemic change – A cyclical process in which the impact of change on all parts of the whole and their relationships to one another are taken into consideration

Descriptive definitions of research constructs related to this study are as follows in the hypothesized order of influence upon the technology integration adoption and implementation process for university faculty:

Peer Support – Either individual or group collegial support provided to an individual prior to making decisions concerning the adoption of an innovation

Institutional Support – Professional development opportunities or assistance provided to university faculty members

Institutional Resources – Hardware, software, incentives or other physical resources provided to university faculty members

Motivation – Either internal or external influences, ideas, beliefs, or perceptions that lead to the adoption and implementation of a technological innovation; includes perceived value or interest in student learning, perceived value on instructional delivery, perceived value on instructional design, and perceived value on collaboration.

Design – Strategies involving technology used by faculty members to design their course instruction

Delivery – Strategies involving technology used by faculty members to deliver or present course content

Student Use – Technology usage by students in their learning environment and activities as a result of faculty direction or requirement

Learning Process – Perceptions of technology's impact on learning processes; includes enhanced student-teacher interaction, enhanced student-content interaction, and enhanced student-student collaborative learning

Student Learning – Perceptions of technology's impact on student achievement and depth of learning

CHAPTER 2

REVIEW OF RELATED LITERATURE

Technology integration into teaching and learning is currently a topic of interest at many instructional and administrative levels of education. The vast amount of computing infrastructure placed in educational facilities over recent years has drawn attention to the fact that educators who are expected to optimally use this equipment in the classroom must be provided professional development regarding what encompasses effective technology integration and how it is accomplished. Effective technology integration involves the interaction of the knowledge areas of technology, pedagogy, and content on the part of the teacher (Pierson, 2001). Paradigm shifts that have occurred in the field of instructional technology indicate a growing emphasis on curriculum integration of technology (Hargrave & Hsu, 2000). Massey (2001) states that “it is the promise and anticipation of what technology can do in the future that is now affecting attitudes and ideas about how we can teach and learn” (p.78).

The growing and increasingly pervasive thrust toward curricular, technological, and pedagogical changes has created a body of literature focused upon those changes and the human factor required to make them occur. This review of relevant literature will center upon several interrelated topics providing the framework and background for this study. These topics, when perceived as parts of a whole, blend to inform how historical and current research guided this study into revealing the oft-overlooked voice of the majority: those faculty members who adopt innovations within their own extended timeframes and in response to their own perceived needs rather than those prescribed by others.

The theoretical framework guiding this study provides a multi-dimensional foundation for investigating the ‘how and why’ of technology adoption by those faculty making up the mainstream. Pertinent research is presented that supports the theories and their relation to the foci of this study. Everett Rogers’ Theory of Diffusion of Innovations, social network models, communities of practice, and the relevant learning theories of situated learning, constructivism, and andragogy all formed an interrelated undergirding of this study.

Topical considerations include the historical perspectives of educational technology which provide a segue into the current drive for effective technology integration at the university level. Varied influences upon this emphasis, such as the university culture, traditional academia beliefs, and presently changing teaching strategies, are included in the review. Furthermore, studies are reviewed emphasizing the responsibility of academics at the tertiary level in influencing future teachers, administrators, and counselors in their budding knowledge areas of technology, pedagogy, and content. This section concludes with literature reviews regarding proposed optimal professional development strategies. Gaps in the literature, as related to this investigation, are discussed and interspersed throughout this chapter, thus, providing added rationale for this study.

A diverse variety of resources were used to locate the reviewed literature. Electronic search tools, such as the Louisiana State University Libraries Catalog and LOUIS, the Louisiana Library Network, were used along with LSU licensed electronic databases. The LSU e-book resource, netLibrary, was accessed and utilized, as well. WebSpirs, InfoTrac, Academic Search Premier, and Web of Knowledge provided access to a large selection of pertinent literature. Educational Resources Information Center (ERIC),

Dissertation Abstracts International, professional organizations' online publications, and governmental reports and documents were accessed via the Internet. Two subscription databases, Association for Educational Communications and Technology - AECT Digital Library and XanEdu, provided further necessary literature to complete this comprehensive review.

Theoretical Foundation

Innovations in any setting and under any circumstance represent the need for change. When studying innovations in a social science setting, the human factor comprises the central focus. In order to study those innovations and accompanying human interactions and responses, a variety of educational and social theories were drawn upon to organize and to help interpret the findings. The foundation for this study was formed with the aid of six pertinent theoretical frameworks. These selected theories assisted in defining the anticipated outcomes and the associated components. Although their origins emerge from different branches of study, the application of each theory to education is prominent. Viewed together as an interrelated network, these theories frame adult learning in active social settings and the methods, choices, rates, and desired results of adopting technology as an integral part of teaching and learning. Each is presented in light of the literature that reflects its formation and use in current and past research.

Diffusion of Innovations

The theory of Diffusion of Innovations, as originally set forth by E. M. Rogers (1962) provides a foundation on which this study is based. Traditionally described levels of innovation adopter categories are innovators, early adopters, early majority, late majority, and laggards. The innovators and early adopters represent a group that is usually

able to work within their own initiative. The early majority and late majority groups require an introduction to the innovation that relates directly to their immediate needs in addition to compelling evidence showing proof of results (McKenzie, 1999, Padgett & Conceicao-Runlee, 2000). Laggards are typically non-adopters. As these categories are not as mutually exclusive as the delineations tend to portray, this study sought to delve deeply into the adoption and implementation patterns and processes of those represented in the central distribution of adopter categories in Rogers' (1995) Adopter Categorization bell curve (Figure 2.1) through participant survey and interview responses. Pertinent to the

Figure 2.1 Adopter categorization on the basis of innovativeness

study was the contribution of social interactions and communications and the adoption processes of the participants in focus. Rogers' Diffusion of Innovations communications theory (Rogers, 1962) has been used as a framework over several decades for a host of studies, in industry, agriculture, and education. Rogers (1995) presents a thorough history of diffusion research and indicates that there is a cross-disciplinary viewpoint today that has evolved over time. He identifies eight main types of diffusion research, of which five

played a role in the development of this study. These five types extracted from his list (1995, p. 94) are:

1. rate of adoption of different innovations in a social system
2. innovativeness
3. diffusion networks
4. communication channel use
5. consequences of innovation

In relation to these types of research, Rogers' (1995) Innovation-Decision Process model (Figure 2.2) depicts the process of adopting an innovation that occurs over time. The five stages are knowledge, persuasion, decision, implementation, and confirmation.

Figure 2.2 A model of five stages in the innovation-decision process (Rogers, 1995)

These stages, as they occur within mainstream faculty members' adoption processes, comprised an integral part of the basis for the hypothetical process model presented later in this paper. Rogers (2004) acknowledges, as a facet within the evolution of his diffusion

model, a focus on networks “as a means of gaining further understanding of how a new idea spreads through interpersonal channels” (p. 19). His formerly linear model of communication now reflects a convergence model where participants create and share information with one another.

Valente and Rogers (1995) indicate that the four main aspects of diffusion are: (1) the innovation-decision process, (2) the roles of information sources or channels concerning the innovation, (3) the S-shaped cumulative rate of adoption, and (4) the personal, economic, and social characteristics of the various adopter categories. The fourth aspect has been the primary focus of recent literature on the adoption of technology by faculty involved in all levels of instruction. The communication sources such as other faculty members and the channels through which this communication flows are important components of the diffusion model and are intricately related to diffusion networks and the roles that communities of practice play in assisting mainstream faculty members to adopt instructional technology innovations.

Diffusion Networks

Both Rogers (1995) and Valente (1995) note the importance and influence of interpersonal networks on the adoption of innovations by individuals. Rogers discusses the concepts of homophily and heterophily in communication networks. “Homophily is the degree to which a pair of individuals who communicate are similar” (Rogers, 1995, p. 286). The common beliefs and understandings between the individuals increase the likelihood that communication will be effective. It is noted that homophilous communication can limit the spread of an innovation to the individuals within the same network. This finding is validated in a study by Durrington, Repman, and Valente (2000)

where a group of university faculty's adoption of technology use was hindered due to lack of communication between friendship networks. In contrast, heterophilous communication is not as easy as homophilous communication due to differing beliefs, but is crucial in diffusion in connecting dissimilar individuals.

Valente (1995) approaches the studying of diffusion of innovations from the standpoint of examining the social network of individuals. He posits "diffusion is a communication process in which adopters persuade those who have not yet adopted to adopt" (p. 2). Diffusion or social networks exist on many levels within a university setting. The research presented in this study sought to reveal the importance and influence of informal networks on the adoption of technology innovations by faculty members.

According to Valente (1995), contagion is a term referring to an interpersonal process of "how individuals monitor others and imitate their behavior to adopt or not adopt innovations" (p. 12). The processes of cohesion, popularity, or system-wide occurrence define the individuals in the network who influence others. Valente's relational diffusion networks reflect the idea that "direct contacts between individuals influence the spread of an innovation" (1995, p. 31). Rogers suggests "we must understand the nature of networks if we are to understand fully the diffusion of innovations" (1995, p. 304).

Communities of Practice

A process of social participation defines this learning theory which centers on the idea of "informal 'communities of practice' that people form as they pursue shared enterprises over time" (Wenger, 1998, Abstract). Etienne Wenger notes that communities of practice are where individuals develop, negotiate, and share the practical, the theoretical, ideals, reality, talking, and doing. These informal communities evolve within the larger

historical, social, cultural, and institutional contexts. Wenger indicates that the source of coherence within a community of practice contains the three dimensions of mutual engagement, a joint enterprise, and a shared repertoire (1998, p. 73). They are viewed as an ideal forum for sharing and spreading best practices and as “the hidden fountainhead of knowledge development” (Wenger & Snyder, 2000, p. 145). Wenger views communities that make learning a central part of its activity as ‘learning communities’ (1998).

Participation is a way of learning a new practice within situated opportunities or with regard to social circumstances (Cobb & Bowers, 1999). Wenger, McDermott, and Snyder (2002) make a pertinent point indicating that communities of practice have been our first “knowledge-based social structures” (p. 5) since the time of cave men, but only recently have they been viewed as a way to manage the knowledge necessary for keeping up with our world’s rapid changes.

As a model of collaborative inquiry, Wesley and Buysse (2001) indicate that communities of practice are often used as a means of professional development for the purpose of improving practice. These authors also tout the benefits of these communities to “transcend organizational and geographic boundaries” thus, achieving “diverse expertise” (p. 118). In seeking unity and not uniformity, leaders, newcomers, and outsiders bring to the community new practices and technologies. These are “adopted by the community through the discourse of its members and the evolution of practice over time” (Schlager & Fusco, 2003, p. 204).

A variety of studies indicate that peer collaboration and/or faculty mentoring are essential components in the quest to encourage all faculty members to adopt technology into their teaching methods (Baldwin, 1998; McKenzie, 1999; Padgett & Conceicao-

Runlee, 2000; Quinlan & Åkerlind, 2000; Sandholtz, 2001; Windschitl & Sahl, 2002).

Several studies and articles emphasize that this strategy is conducive to building the critical mass needed to implement a paradigm shift (Hartman & Truman-Davis, 2001; Lan, 2001; Padgett & Conceicao-Runlee, 2000). It has proven to be an effective method in increasing faculty knowledge of alternative approaches and facilitating faculty responsibility as being “primary innovators and initiators of change in academe” (Camblin & Steger, 2000, p.1).

Learning Theories

Situated learning, constructivism, and andragogy provided a theoretical framework for this study in regard to learning environments. Each contributes a facet of the learning environment necessary for open, collegial, adult-level learning. The need for presentation of knowledge in authentic context and that learning requires social interaction and collaboration are the two basic principles undergirding the theory of situated learning (Lave, 1988).

Lave’s theory of situated learning (1988) states that learning is a function of the activity, context, and culture in which it occurs with social interaction as a critical component. Lave and Wenger (1991) describe the unintentional learning that occurs within communities of practice as members become more active and engaged within the culture. These two researchers and theorists further the discussion with their idea of legitimate peripheral participation based on the premise that learning is a process of participation in communities of practice and the participation is at first peripheral, but increases gradually in levels of engagement and complexity. Lave and Wenger (1991) later refer to situated learning as learning by doing.

Situated cognition theory and situated learning are considered to be emerging views and works in progress (Kirshner & Whitson, 1997) relying on “social and cultural determinants of learning” (Driscoll, 2002, p. 62). This study’s focus upon the mainstream faculty and their participation in communities of practice correlates with the ideas and theoretical underpinnings of Lave’s theory. This view of learning as “an integral part of generative social practice in the lived-in world” (Lave & Wenger, 1991, p. 35) defines the authors’ way of understanding learning.

Barab and Duffy (2000) drew from each of their research backgrounds in situated learning and constructivism and wrote that “although (they) draw on different references and clearly have specialized languages, actual interpretations of situativity and of constructivism share many underlying similarities” (p. 25). Their key proposal stated that “knowledge is situated through experience.” (p. 25). Constructivist approaches to learning are also prevalent in the type of learning environments within communities of practice. Driscoll (2002) indicates that these complex learning environments engage learners in discipline-authentic activities, provide for collaboration, allow for self-regulated learning, and encourage reflection. Wenger, McDermott, and Snyder (2002) define a community of practice’s elements of “a domain of knowledge, which defines a set of issues; a community of people who care about this domain; and the shared practice that they are developing to be effective in their domain” (p. 27) in terms that reflect Driscoll’s constructivist learning environment.

There are a variety of perspectives regarding the philosophical framework of constructivism. This approach to learning involves the learner actively imposing organization and meaning on their environment and in the process, construct knowledge

(Driscoll, 2002). The interplay of the environment, individual meanings rooted in experiences, and the instructional experiences provide a basis for the situated cognitive experiences that result in constructivist learning (Thompson, Simonson, & Hargrave, 1996). The sociocultural constructivist view sees learning as a process of “acculturation into an established community of practice” (Duffy & Cunningham, 1996, p. 175).

Driscoll (2002) points out that there must be essential learning conditions and instructional strategies that support constructivist learning. This necessitates “the creation and use of complex learning environments” (2002, p. 66). Imperative components include authentic learning activities, opportunities for collaboration, learners regulating their own learning, and the encouragement of reflection.

Jonassen, Peck, and Wilson (1999) discuss constructing meaning in regard to its social aspects. They indicate that we converse and share with others our views on importance and meanings, that our perceptions of the world affect our beliefs, that meanings often evolve as a result of some type of dissonance, that reflection and articulation are essential components, that meaning can be derived from conversations with others, and that our meanings are influenced by others. These social features of the construction of meaning are prominent aspects of the activities that take place in learning communities and result in newly constructed knowledge by its members.

Andragogy, a learning theory specifically directed toward adult learners, was developed by Malcolm Knowles (1978). He emphasizes how adults learn in that they are self-directed, need to learn experientially, approach learning as problem solving, and learn best when the topic is of immediate value. He posits that instruction for adults should be more problem-centered rather than content-centered and should involve adults in the

planning and evaluation of their instruction. Instruction should build on experience and should allow for the engagement of “mutual inquiry” (1978, p. 31). These assumptions of this theory complement the type of learning that takes place within communities of practice and inform the design and creation of professional development opportunities that allow for the empowerment of adult learners. In regard to professional development, the theory of andragogy prescribes that individual differences should be accounted for and differences in “style, time, place, and pace of learning” (p. 31) require consideration.

The consideration that adults benefit from self-directed learning relates directly to the processes inherent to communities of practice. This potential form of professional development addresses the needs of adult learners and provides for the application of all andragogy principles.

Historical Perspectives of Educational Technology

The term, *educational technology*, emerged in literature around 1948 (Saettler, 1990), but the idea of educational technology has been in existence from the time of early man. From the recording of pictographs and subsequent instructional technique development across cultures, Saettler (1990) notes that the technology of instruction reflected particular ways of thinking, acting, speaking, or feeling. Further notation indicated that significant shifts in educational values, goals, or objectives have led to diverse technologies of instruction. These technologies of instruction take on many varying forms, ideas, concepts, strategies, and tools used in the total application of educational technology.

The definitions that have evolved over the last half century slowly metamorphosed from targeting audiovisual communication in the learning process to instructional

technology being described as a process. A third definition incorporated the term ‘educational technology’ as a field involved in the facilitation of human learning. Further tweaking produced a definition that listed the factors involved in the process. The Association for Educational Communications and Technology (AECT) is responsible for authoring the most recently updated definition for instructional technology (IT) (Thompson, Simonson, & Hargrave, 1996). The current definition adopted in 1994 states, “Instructional technology is the theory and practice of design, development, utilization, management, and evaluation of processes and resources for learning.” (Reiser & Ely, 1997). The authors of this definition were noted to consider IT and educational technology (ET) to be synonymous, as do Reiser and Ely (1997). The currently prominent acronym, IT, used outside the realm of education refers to Information Technology which largely encompasses data processing and communications as well as other foci.

Saettler (1990) documents in his text the early instructional theories and methods that lay the groundwork for modern educational technology. He also chronicles the evolution of media, such as film and radio, which characterized educational technology in the early- to mid-1900s. The field focused upon communication theory, behaviorism, cognitive science, instructional design, and broadcasting through the 1980s. At this time there was an emergent focus on information exchange, educational research, instructional television, and programmed instruction. Throughout the 1980s and 1990s there was interest in information technologies, cognitive processes in teaching and learning, and the educational impact of computers.

Research in the field of educational technology has been reported for over 90 years based upon information provided by Thompson, Simonson, & Hargrave (1996). Early

research was dominated by media studies of four primary types: evaluation, media comparison, intra-medium, and aptitude treatment interaction. Over time, the early behaviorist theory-based studies slowly gave way to more cognitive theory-based approaches. The emphasis on a constructivist perspective on learning and the rallying criticism of research methods spearheaded by Richard Clark (1983), effectively ended media comparison studies. Kozma's (1991) opposing views to Clark's stance provided a call for research on the contributions of a technology-based method rather than the medium itself.

The early quantitative studies conducted are presently being accompanied by more naturalistic, qualitative research (Driscoll & Dick, 1999). Thompson, Simonson, and Hargrave (1996, p. 24) indicate that "a naturalistic research approach will assist in producing information that will influence the design of instruction to match individual needs." Research in the field of educational technology is changing in response to a current emphasis on exemplary teaching strategies and the need for evidence of technology's impact on student learning.

Roblyer and Knezek (2003) were involved in the development of the new National Educational Technology Plan (U.S. Department of Education, Office of Educational Technology, 2005). This recent undertaking led them to evaluate past educational technology research and contemplate where it has been and speculate where it should be heading. These two authors and prominent educational technologists suggest the need for new research to study technologies as "components of solutions to educational problems" (p. 63), and to address relative advantage, the impact on student achievement, the

achievement of societal goals, and to provide information to guide the use of emerging technologies in education.

Current emphases in the field of educational technology reflect Saettler's view that "any change in educational technology will be evolutionary rather than revolutionary" (1990, p. 539). Feurzeig (as cited in Saettler, 1990) notes that:

The prospects for advancing education through information technology require, for their success, a great deal in the way of nontechnological developments. These include such things as creating the necessary human resources, primarily skilled teachers who like to teach and who are knowledgeable in the subjects they teach and in the use of computer tools they teach with. (p.538)

Though written in 1988, thoughts similar to his continue to resonate in the literature, research, goals, and expectations of those interested in and responsible for effective technology integration into teaching and learning.

University Culture, Academia, and Teaching

Higher education faculty members work within an academic culture that exerts a strong influence on the adoption and diffusion of educational technology in the classroom via encouragement or discouragement of innovation and risk-taking (Jurow, 1999; Smith, 2000). Two separate studies by Clark and by Austin (as cited in Smith, 2000) posit that "faculty operate within four overlapping, yet distinct, cultures" (p.149). These consist of the academic profession in general, the individual discipline, the specific institution as an organization, and the institutional type. Damrosch (1995) describes how academic structures have remained relatively constant although societal conditions have changed. The institutional arrangement of the isolation of disciplines and then of specialized fields

within the disciplines creates “scholarly alienation” (p. 6). He calls for renewed attention to ways of bringing together groups with differing perspectives in order to further the strengths of specialized work and individual identity. Quinlan and Åkerlind (2000) note Adkison’s 1976 study that found varying degrees of social isolation in departments that represent different disciplines. Szabo and Sobon (2003) indicate the creation of working collaborative communities is often difficult to attain in the university setting where faculty are rewarded based upon their strong individual scholarly performance. Important values within higher education revolve around academic freedom and autonomy; however, Quinlan and Åkerlind (2000) indicate in their case study research that frequent faculty interaction and collegial communication increases the likelihood of discussions on issues related to teaching.

Being a faculty member at a Research I university adds additional responsibilities and expectations. Teaching, research, and service are common workload components, but there is a stronger emphasis on research. These three basic areas contain responsibilities such as, supervising, advising, mentoring, research development, scholarship, grantsmanship, service to the university, and service to the community (Davidson-Shivers, 2002). The culture of particular institutions determines, further still, which of these components receives the most emphasis in the reward structure, tenure, and promotion.

The academic professional culture involves faculty teaching and learning. Rentel and Dittmer (1999) indicate that in addition to being “premier scholars” (p.23), university faculty are also viewed as teachers. Faculty members across disciplines often see teaching differently from those engaged in the business of preparing future teachers. In addition, the atmosphere within the individual discipline plays a role in technology integration by

faculty (Walvoord & Pool, 1998). Traditions, history, resources, styles of leadership, reward structures, teaching load, physical space, collegial relationships, and governance are a few of the many areas of potential differentiation among colleges and departments (Mehlinger & Powers, 2002). Differing funding structures for departments, support from chairs, and collegial identity among colleagues all contribute to the rate of diffusion of technology within a specific discipline (Smith, 2000). The author further indicates that support for technology use from the institutional organization contributes to the ability of faculty to integrate technology by providing the necessary infrastructure and technical support.

Higher education institutions are undergoing substantial changes due to the surge in technology use. Pedagogical issues, technical issues, and leadership issues are evident. Curriculum emphasis is shifting to more active and less authority-dependent teaching and learning (Davidson-Shivers, 2002; Smith & Ragan, 1999). Evolving higher education institutions exhibit changes in student-centered, multicultural, global oriented, outcome-oriented, asynchronous education (Nasseh, 2000). Where the design and delivery of courses and curricula have been a faculty prerogative, the trend toward learner centeredness and market-driven education is having an impact on the role of faculty (Graves, 2001).

Changes in the traditional authority centered method of instructional delivery within higher education institutions to learner-centric thinking carry important implications for the revision of pedagogy (Baldwin, 1998; Cravener, 1998; Dusick, 1998; Stahlke & Nyce, n.d.). Academics are recognizing the importance of going beyond “mere exposition” when it comes to teaching students (Laurillard, 2002, p. 184). The art and science of

teaching is expanding amidst the bounds of teaching, scholarship, and research. Higher education is experiencing a conceptual change that involves teachers' rethinking and modifying their educational beliefs and values and developing a spirit of inquiry and continuous learning (Tam, 1999). Educators must incorporate change within their teaching practices in order for technology to become a seamless addition to their classrooms. Ertmer (1999) refers to the multiple dimensions of practice that must change as being personal, organizational, and pedagogical. Dusick (1998) labels the same factors as personal, environmental, and behavioral. Regardless of the nomenclature, changes must be made in order for veteran and new educators to create technology-rich learning environments that are most likely to be dissimilar to environments within their own experiences (Jurow, 1999).

The inclusion of reflective practice is noted in Grant's (n.d., ¶ 8) comprehensive description of teaching:

Powerful teaching is a deeply intellectual activity, involving asking questions, observing carefully, making connections between discrete experiences, developing approaches and solutions based on needs of one's students and classroom, and reflecting on practice.

Schön (1983) describes reflective practice as the conscious interaction by the practitioner with a problematic situation, and the accompanying conversation and experimentation.

Laurillard (2002) notes that although academics are highly competent in their chosen field, they are not generally known for being reflective practitioners.

Seeking to discover information regarding effective teaching at the university level, Hativa, Barak, and Simhi (2001) conducted a study involving four case studies of

exemplary teachers. They were interested in the faculty's thinking, beliefs, and knowledge about teaching and the relation to the use of effective teaching strategies. It was discovered that the fit between their beliefs and knowledge concerning effective strategies and their classroom practice was not a perfect fit. The researchers urged the use of reflection by faculty concerning how successful they believed their implementation to be.

Recognizing that academics are trained as researchers and not as teachers, Kane, Sandretto, and Heath (2002) were interested in studying the beliefs that academics hold about their teaching. This review of fifty studies resulted in the researchers concluding that overwhelmingly, the entire story is not being told. Actual teaching practice is not generally documented in relation to the teachers' beliefs and therefore lacks sufficient evidence to formulate definitive conclusions.

Serow, Van Dyk, McComb, and Harrold (2002) were also interested in "the voices of faculty members caught between the demands for research productivity and requirements of sound instructional practice" (p. 26). Their qualitative study of ninety-two interviews of full-time faculty at five research-intensive universities resulted in defining two distinct cultures of undergraduate teaching at research universities. These were entitled the Official culture which was associated with institutional faculty development initiatives and the Oppositional culture which reflected resistance to organized instructional reform. Interestingly, the Oppositionists also resisted an emphasis on research productivity as a dominant faculty role.

University Faculty Influence on Future Educators

Although academics are charged with creating and dispersing knowledge, there is an additional need to model good teaching practices to students that will eventually join

the teaching ranks. The importance of this is considerably more notable within colleges of education and teacher preparation. Not only are future teachers being trained, but administrators and counselors are, as well. Teaching and learning are central to the mission of the college and faculty members are responsible for ensuring that these future educators have exemplary experiences while in preparation.

Faculty development opportunities in technology integration into curriculum were developed initially for K-12 in-service teachers following the state and national emphases on providing district and school infrastructure and equipment. There is now an increasing demand on teacher preparation programs to adopt this mode of teaching in order to ensure that pre-service teachers are entering the profession qualified to effectively integrate technology into the curriculum (Web-Based Education Commission, 2000). Federal, state, and local directives and leadership initiatives are driving this emphasis to include all university faculties, particularly those who play a role in the total education of future teachers. Arts and sciences faculty members are being made aware of their invaluable contributions to the development of future teachers and the importance of modeling effective teaching and technology integration (Seider, Ferrara, Rentel, & Dittmer, 1999). Higher education is thus in the process of adopting a technology integrated model instituting changes in both pedagogy and course structure (Moursand & Beilefeldt, 1999).

Lan (2001) points out that the emergence of technology “might have thrust the young, non-tenured, but technically prepared faculty into new and different leadership roles” since the mature professors in the traditional leadership roles are not the predominant proponents of technology integration. Davidson-Shivers (2002) notes that change is occurring most frequently among assistant and associate professors; followed by

instructors and full professors. Gilbert and Green (1997) and Sanders (2001) indicate that faculty is now thinking about the knowledge base in their field as a dynamic entity that requires frequent update and changes.

There is a belief in our society that students will have vastly increased opportunities to become technology-proficient members of this technological age and future workplace if they are educated by teachers that model technical and technology integration competence (International Society for Technology in Education [ISTE], 2002; ISTE – Center for Applied Research in Educational Technology [CARET], 2002). In order to succeed in this quest, educators must view technology as an imperative component of the total educational experience for learners. For teachers to adopt this mode of thinking, they must possess technical skills in computer operation, access to appropriate equipment, knowledge of effective integration strategies, time to assimilate and create curriculum adaptations, and support from leadership (U.S. Department of Education, Office of Educational Research and Improvement, 2000).

Specifically within teacher preparation programs, Moursand and Bielefeldt (1999) noted that teachers-in-training routinely do not experience the use of technology in their field experiences, nor do they routinely have supervisors who are able to advise them on using technology in the classroom. The report by the National Center for Education Statistics stated that only 51% of public school teachers felt that college/graduate work had prepared them to use computers (U.S. Department of Education, Office of Educational Research and Improvement, 2000).

Pope, Hare, and Howard (2002) found in their study which investigated the gap between teaching the use of technology and the use of technology in learning to teach

among pre-service teachers that the technologies need to be modeled by the faculty in order to increase pre-service teachers' confidence levels. The study conducted by Russell, Bebell, O'Dwyer, and O'Connor (2003) substantiates these findings. Teacher preparation programs are encouraged to focus on teaching with technology in a variety of ways and to capitalize on specific instructional uses. A thorough empirical study was conducted by Dexter and Riedel (2003) with findings indicating that instructional support was a significant predictor of student teachers having their K-12 students use technology. The importance of the cooperating teacher in this finding emphasizes to teacher preparation programs that these support personnel are also responsible for modeling the appropriate use of technology to future teachers. "Technology is coming to represent both a constant resource and a continual reminder that educators never can become satisfied with their methods, skill levels, or results" (Roblyer & Edwards, 2000, p.235).

University Faculty Use of Educational Technology

Standards

Seeking to address these and other needs for technology integration in the preparation programs of teachers, colleges of education are developing plans and implementing strategies to meet the professional goals and expectations of individual faculty, administration, and society (Rogers, 2000). The NCATE 2000 Standards (National Council for Accreditation of Teacher Education [NCATE], 2002) are a driving force to incorporate technology use and integration into all facets of the teacher education program. These standards have a recurring technology thread throughout the document. Standard 5: Faculty Qualifications, Performance, and Development states for achieving target level within Modeling Best Professional Practices in Teaching, "Teaching by the

professional education faculty... integrates diversity and technology throughout coursework, field experiences, and clinical practices” (NCATE, 2002, p.34). In conjunction with NCATE, the ISTE NETS for Teachers (2002) initiative provides educational technology standards and performance indicators for teacher candidates throughout the stages of their development toward becoming practicing teachers.

Incentives

Institutions with a merit, tenure, and promotion system supporting research as a primary means for advancement can hinder technology integration, in that faculty are left with little time to learn technology integration strategies, construct enhanced technology-rich curriculum, and implement new teaching strategies that promote the use of technology (Anderson & Starrett, 2001; Smith, 2000). Kenneth Green’s (2002) Campus Computing 2002 report notes that IT as a part of the tenure and promotion process is only in 17.4 percent of reporting institutions. Seminoff and Wepner’s study (1997) focuses upon the value of technology-based projects in tenure and promotion decisions. That eight-year old study addresses conversations that are on-going today.

Stone (1999) suggests that universities must develop policies that address additional barriers to technology integration, such as intellectual property rights, faculty workload, and compensation. Incentives of varying natures were indicated as enabling, necessary, and rewarding by several studies. These included mini-grants, stipends, release time, equipment, fellowships, and recognition, all of which contribute to a culture that encourages innovation (Camblin & Steger, 2000; Hartman & Truman-Davis, 2001; Lan, 2001). Other recommended means of promoting technology integration among faculty are accreditation, coursework, and a reduced teaching load (The CEO Forum on Education and

Technology, 1999). A factor in easing the transition from non-use to effective integration of technology is providing a means for the change agents and initiatives to be “the result of a constructive and collaborative effort” (2001, p. 11), as noted by Hagner and Schneebeck.

Barriers

University faculty members have been among the last educators to experience the educational thrust toward technology integration. Now viewed as those responsible for preparing future technology-using professionals, the faculty is realizing the variety of barriers causing slow adoption. Although there are barriers noted in the literature, such as, lack of hardware and software, lack of time, lack of funding, inadequate facilities, and few support services, Baldwin (1998) refers to Geoghegan’s belief that an aversion to risk is the central barrier encountered by non-adopters. Mehlinger and Powers (2002) noted several possible justifications by non-adopting faculty members. These include their judging of technology as a threat, as “an ineffective substitute to traditional instruction” (p. 280), as an increase to their workload, and as a factor which makes education impersonal. Hagner and Schneebeck (2001) offer an additional attitudinal barrier of the faculty member’s reluctance to assume the role of a student. Those perceptions of technology use perceived as barriers played a central role in this investigation.

Faculty, faced with mounting pressures to integrate technology into their teaching and learning, often must re-evaluate their traditional belief system about their instructional methods (Ertmer, 1999). This, along with apprehension about technology competency, attitudes toward technology, and degree of motivation for change, all contribute to the rate of technology integration by faculty members. The 1999 UCLA national faculty survey (as cited in Epper, 2001) indicated that 67% of college faculty felt that “keeping up with

information technology” (p.8) was a source of significant stress, outranking research and publishing demands, teaching load, and review and promotion. Epper (2001) also notes that regardless of what faculty members believe about technology’s ability to improve teaching, “its presence has sparked the most thorough self-examination of teaching and learning in recent history” (p.13).

Professional Development for University Faculty

According to Mehlinger and Powers (2002), prior to the introduction of technology, professional development at the higher education level consisted mainly of sabbatical leaves so that the faculty member could provide his or her own experiences. The authors’ writing currently summarizes the four most common types of professional development for university faculty as: (1) providing funds for course revision during the summer, (2) funding conference travel, (3) providing group classes through a full-time professional staff, and (4) providing skilled student mentors to faculty.

The beginning point for successful professional development lies in conducting a needs assessment to identify varied needs from the level of the organization, the learning context, and the individual (Picciano, 2002; Robinson, 1998). The needs assessment provides the means to identify “the strategy and action required to improve current and future practice” which is a primary goal in effective technology integration (Lan, 2001, p.386). A study of ubiquitous computer access and teachers’ shifts to constructivist pedagogy revealed that development opportunities should be subject-specific leading to determining how various modes of inquiry can be supported with technology (Windschitl & Sahl, 2002).

An important component in faculty development design and its relationship with the faculty are the perceived benefits of instruction by the faculty. Particularly with technology integration, learners must ascertain a sense of need for the instruction for it to be effective in changing their beliefs, behaviors, or even skill levels (Lan, 2001; Strudler & Wetzel, 1999). If the ultimate goal of revised pedagogy is to be accomplished, faculty must be able to understand how technology can transform instruction, yet not become overly concerned with becoming technicians rather than content experts (Dusick, 1998).

The Guskey (1994) literature review, though dated, provides observations of best practice that are applicable today and to both K-12 teachers and higher education faculty. It is pointed out that although studies tend to search for the one single best approach, it is the mix of optimal strategies that affect the most changes. Recognizing professional development as an individual, on-going process is imperative for success. Encouraging collegiality and professional respect within opportunities for collaborative support is an additional characteristic of best practice. Previous research has indicated that knowledge about instructional uses of technology for university faculty members was socially constructed (McAlpine & Gandell, 2003; Brown, Collins, and Duguid, 1989). The provisions for on-going support, just-in-time assistance, and opportunities for feedback are additional success factors in exemplary programs also noted by Bradshaw (2002). Bates (2001) survey results of 35 institutions of higher education revealed that instructional technology professional development works best when embedded in actual teaching practices.

Studies have indicated that a major factor in successful faculty development is the intrinsic and extrinsic motivation of the individual faculty member (Surry & Land, 2000).

The uniqueness of each learner brings a wide variety of interests, anxiety levels, and values to the learning environment. Faculty will enter the quest for technology integration and technical instruction from a wide variety of motivational levels. Surry and Land (2000) developed sets of strategies for increasing faculty motivation to use technology based upon John Keller's ARCS Model of Motivational Design's four succinct categories. The strategies for attention gaining, relevance, confidence building, and satisfaction provide a solid framework for designing motivational instructional strategies and materials (Keller, 1987).

In order to ensure additional success in meeting goals and encouraging change, professional development should be based upon adult-learning theories and research. The understanding of andragogy, a theory regarding the teaching of adults, is a necessary component for success in adult instruction for faculty and professional developers (Cravener, 1998; Davidson-Shivers, 2002; North Central Regional Educational Laboratory, 1999). Diverse understanding about necessary technical issues, as well as pedagogy and course design helps to ensure success in designing appropriate faculty development opportunities for higher education faculty, which, in turn, supports achievement of goals and expectations of technology integration.

As a preface for understanding the individual characteristics of effective faculty development programs, Lim (2000) states that "training and development should not be an afterthought. It should be a vital part for any successful implementation plan for technology in education" (p.243). The CEO Forum on Education and Technology (1999) report indicates that, "Professional development for teachers is an ongoing, long-term commitment that begins with the decision to pursue a career in education and continues,

through a combination of formal and informal learning opportunities, for the duration of a career” (p. 8). Long-term, sustained higher education faculty development strategies that continually evolve are proposed by Camblin and Steger (2000) as potentially effective methods. Faculty development must be accompanied by support services that enable technology users to sustain their initiatives (Mitra et al., 1999).

As most of the literature on best practices in professional development was written from the standpoint of the K-12 teacher, generalizability to higher education faculty is questionable on some points. The aforementioned cultures affecting technology integration at the higher education level are a relevant consideration when designing faculty development and integration strategies. Quinlan and Åkerlind (2000) note that “developmental activities that occur within departments or disciplines are likely to be seen by individual professors as more relevant to their personal situation and more directly transferable to their teaching practice” (p. 24). Higher education-specific studies need to be conducted in order to document significant factors affecting technology integration.

Literature regarding professional development in technology for university faculty consists mainly of case studies, reports, book chapters, papers, and articles. Little empirical research has been conducted in this field and the current body of knowledge garners the majority of its support from studies qualitative in nature (Garet et al., 2001). An additional limit to the research conducted concerning professional development is that it overwhelmingly makes use of volunteer participants, thus limiting findings about the individuals who may need the professional development opportunities the most (Bobrowsky, Marx, & Fishman, 2001).

Providing technology instruction to faculty often encounters extrinsic barriers that may cause frustration before even beginning the integration process (Ertmer, 1999). These are generally related to equipment access, time for adequate training and the follow-up practice needed for success, lack of administrative support, and the absence of technical support (Bruce & Goodall, 2001; Cyrs, 1997; Dusick, 1998; Ertmer, 1999; Groves & Zemel, 2000; North Central Regional Educational Laboratory, 1997). Many of these issues must be addressed at an administrative level and supported by all involved.

If university faculty members are to make requested paradigm shifts in instructional methodology, appropriate faculty development opportunities must be made available that address the university cultural climate, specific needs of faculty, goals of the university and individual colleges, and the infrastructure supporting instructional change (Davidson-Shivers, 2002; Seider, Ferrara, Rentel, & Dittmer, 1999; Web-Based Education Commission, 2000). In addition, research is needed in making the connection between appropriate professional development activities and what students learn as a result of teachers' participation (Bobrowsky, Marx, & Fishman, 2001).

As Pierson (2001) succinctly indicates from her study, technology will hold the position of a peripheral ancillary to teaching unless a teacher views it as an integral part of the learning process (p.427). Dooley (1999) reports that technology innovation must become a part of a teacher's teaching repertoire. Pedagogical goals must be a driving force for technology use to be effective in the classroom (Donovan & Macklin, 1999). Professional development has been delivered in the traditional group formats of in-service workshops, seminars, and institutes. According to the National Council for Accreditation

of Teacher Education (1997), nontraditional methods of delivery should increasingly be utilized.

Models of Instructional Design, Professional Development, and Technology Integration

General Models

Instructional design is defined by Collins and Berge (2003) as a “discipline that employs systematic processes involving the use of learning and instructional theory to insure educational quality and optimal student learning environments” (p. 21). P. L. Rogers (2002) indicates that instructional design yields prescriptive procedures for designing instruction. This process has evolved from the early 1960s surfacing in various iterations and models. Throughout the 1990s, there was an increased emphasis on instructional design due to the growing interest in constructivism, use of the Internet, and knowledge management (Reiser, 2002).

The classic model by Dick and Carey (1985) is a step-wise flowchart involving needs assessment, task analysis, analysis of the learner and learner characteristics, goals identification, performance objectives identification, development of assessment instruments, selection of instructional strategies and materials, formative evaluation, and summative evaluation. The process is considered iterative for needed revisions and refinements.

According to Smith and Ragan (1999), there are over forty models and their steps are either sequential or concurrent. Models have emerged centered around different foci, such as curriculum, learner knowledge, higher-order thinking, and constructivism (Rogers, 2002). These are now reflecting structures different from the earlier linear step models. It is not uncommon for models to exhibit spiral, circular, or knotted configurations, which

emphasize the interaction of elements. Despite the numerous instructional design models, almost all are based on the generic “ADDIE” model, which stands for Analysis, Design, Development, Implementation, and Evaluation.

Advantages for using systemic instructional design are listed by Smith and Ragan (1999, p. 8). These are as follows:

- encourages advocacy of the learner
- supports effective, efficient, and appealing instruction
- supports coordination among designers, developers, and those who will implement the instruction
- facilitates diffusion/dissemination/adoption
- supports development for alternate delivery systems
- facilitates congruence among objectives, activities, and assessment
- provides a systematic framework for dealing with learning problems

These advantages have served as a basis for continual reflection and proposed revisions of this process to extended applications.

Professional Development Models

Taking the instructional materials and curriculum emphases, along with the noted advantages of using instructional design, models for professional development have emerged. Urged on by the concerns about the effectiveness of inservice education, teacher attitude studies and effective practice studies led to the formulation of several staff development models (Sparks & Loucks-Horsley, 1989). The five general models presented by these authors are accompanied by extensive discussions of the theoretical

underpinnings, the activity phases and the expected outcomes of each model. The models focus upon the processes of (1) individually-guided staff development, (2) observation/assessment, (3) involvement in a development/improvement process, (4) training, and (5) inquiry.

Schrum (1999) notes the significant amount of research that has been conducted on effective staff development models over the course of the past several decades. She attributes Joyce and Showers (1983) with the development of the four different models of staff development (1) theoretical basis of rationale; (2) theory, plus observation of demonstrations by relative experts in the model; (3) theory and demonstrations, plus practice-plus-feedback in relatively protected conditions; and (4) theory, demonstrations, and practice, plus coaching each other as ongoing, collegial follow-up.

A theoretical model developed by Stein, McRobbie, and Ginns (1999) highlights the need for professional developers to be cognizant of teachers' prior knowledge and beliefs about teaching and learning. These authors express within their model the need for a combination of theoretical, practical, and reflective experiences. They acknowledge that professional development in technology is not static, happening in educational contexts where teachers work and where they find meaning.

Adaptations and a wide variety of variations and applications mark professional development models today. Recent work has been done to develop professional development models designed to benefit higher education faculty members. Woodell and Garofoli (2003) have proposed a faculty development model designed to provide a support system to the differing levels of need of university faculty members. Their cyclical model provides for online components focusing upon project-based outcomes, content instruction,

and knowledge sharing. The authors promote communities of practice as a means for knowledge sharing among faculty.

Technology Integration Models

Just as models have been developed for general professional development usage, those for achieving technology-enhanced teaching and learning continue to emerge in the literature. Dooley (1999) proposes a holistic model of adoption and diffusion based upon the Concerns Based Adoption Model (Hall, Wallace, & Dossett, 1973), a model dealing with the concerns of teachers about the adoption of technology, and Rogers' (1995) stages in the innovation decision process. Dooley's diffusion model seeks to aid institutions with the change process.

Realizing the large numbers of factors influencing technology integration, Sherry (1998) developed a structural model of technology adoption and diffusion comprised of technological, individual, organizational, and teaching and learning factors in conjunction with the learning process. The model emphasizes moving through four stages of change and the importance of support and a shared vision by educational system members.

Cautioning against the "one size fits all" model of technology professional development (Brand, 1998), the idea of individualizing technology learning is emerging. Howland and Wedman (2004) developed a process model for faculty development for individualizing technology learning entitled the Technology Learning Cycle. Their process-oriented perspective included the components of technology awareness, exploration and filtration, learning of technology, personal and professional application of technology, and sharing and reflection.

Instructional design models guide faculty in using technology in teaching to “examine and answer for themselves questions that they may not have considered in the past” (Collins & Berge, 2003, p.21). These authors have developed an outcomes-based model to assist post-secondary faculty members in structuring their courses using technology for teaching and learning. Their model urges an alignment of learning outcomes, learning activities, and evaluation/feedback. The influence of instructional design is consistent in current models being developed and although a central model is not applicable to all, the various aspects of teaching, learning, professional development, and technology integration are constantly being evaluated and developed further in the quest for comprehensive and essential guidance for educators’ development.

Summary of Literature and Implications for the Study

Reviewing a wide variety of scholarly artifacts has provided an overview of the research foci in the areas of diffusion of innovations categories, diffusion networks and communities of practice, motivation for change, how adults learn best, constructivist learning, and situated learning. These areas of study formed an interrelated framework for this investigation of the reasoning, selection, implementation, and resulting changes of mainstream higher education faculty’s adoption of technology innovations.

These faculty members, comprising the majority of Rogers’ adopter categories, are infrequently the direct focus of technology adoption and implementation research. There appears to be a generalized view that the smaller percentage groups of early adopters and innovators should be targeted in professional development and planning in order for them to act as models for the majority. The voice of the majority in their adoption decisions,

preferred methods of professional development, and use of technology for effective teaching is rare in the literature.

As technology in teaching and learning has evolved over the past decades, it has been slower to reach the university setting than the K-12 environment. Large expenditures for technology were first directed to elementary and secondary classrooms. Professional development for K-12 teachers has also evolved over the years from a focus on the skills needed for the use of technology tools to the emphasis on student achievement as a result of the integration of technology-enhanced strategies. This emphasis on effective use of technology in the classroom has reached the post-secondary level of education and university faculty members are currently revising and enhancing their teaching strategies. This has been slightly more challenging at the post-secondary level due to “disparate faculty interests, high autonomy, and wide variance in technology expertise” (Howland & Wedman, 2004).

Faculty members reflect a wide variety of levels in the adoption diffusion process with the majority at a medium or low level of use as proposed by Rogers’ (1995) distribution of those comprising adopter categories. With national, state, and institutional emphases focusing on effective technology use, university faculty juggle incorporating technology into their teaching along with the conventional responsibilities of research, scholarship, advising, mentoring, and community service that their faculty positions require. The struggles, hurdles, attempts, and successes of the majority of faculty members in integrating technology is a story that needs to be told to inform the development of effective professional development strategies that can ease their transition through the adoption diffusion process.

Instructional design models have guided the development of general professional development models and more specific technology integration models. These varied types of models mainly feature cyclical structure with varied entry points and opportunities for reflection and revision. Most models described in the literature are directed to K-12 classroom teachers in a more structured environment than is experienced by university faculty. Models for university faculty members' technology integration into teaching and learning are emerging particularly due to the emphasis on creating courses for online learning. Regardless of the technology focus, professional development should address particular needs of the faculty members and be designed to augment their adoption and implementation process.

CHAPTER 3

RESEARCH METHODOLOGY

In seeking information concerning university faculty members' technology adoption and implementation processes, this study was designed to reveal the voices of members of the mainstream faculty concerning their perceptions, motivations, and experiences involving educational technology. This research study employed a mixed methods approach using both quantitative and qualitative data. The purpose of using quantitative survey and qualitative interview data was to provide both breadth and depth of information concerning mainstream faculty use of educational technology in teaching and learning. Investigating a wide array of adoption and implementation process information necessitated the use of multi-method research procedures. Details of the methodology are described in the following sections: (1) Research Questions, (2) A Conceptual Model, (3) Research Design, (4) Setting, (5) Population and Sampling Methods, (6) Instruments, (7) Pilot Data Collection, (8) Study Data Collection, (9) Methods of Analysis, and (10) Summary.

Research Questions

The following research questions that emanate from the literature and from the researcher's professional practice guided this research study.

(RQ1) What factors enable a mainstream faculty member to adopt technology innovations into their personal teaching and learning?

(RQ2) What role does institutional support play in adoption and implementation of educational technology innovations?

(RQ3) What role do institutional resources play in adoption and implementation of educational technology innovations?

(RQ4) What role does informal membership in communities of practice play in adoption and implementation of educational technology innovations?

(RQ5) What role does technology in instructional design and delivery play on the learning process and student learning outcomes?

Conceptual Model

Based on the research questions and the literature reviewed, a conceptual model of a faculty technology integration process was first developed. This conceptual model had as its origination point general instructional design principles, theoretical frameworks, and general professional development and technology integration models currently in the literature. The theoretical and other topics reviewed in the literature review helped shape the development of the conceptual model. Communities of practice and the socialization of learning through diffusion networks created a central theme important in the hypothesized process of technology integration represented by the conceptual model. Rogers' (1962) theory of adoption and diffusion of innovations played a large role in the linear conceptualization of the hypothesized model. Theories proposed by Wenger (1998) concerning communities of practice urged the researcher in the conceptualization of the role of peer support in the technology integration process.

University culture and faculty use of technology informed the structural development of the model where these components play into the steps of the process leading through instructional design and delivery. Other influences upon the specification of this model, as noted by Mertler and Vannatta (2005) as relevant contributions, were

personal observations, personal experiences with the topic, expert opinions from professorial faculty, common sense and logic.

A unique aspect of this study was the focus upon the mainstream faculty comprising the 84% of the population of adopter categories (Rogers, 1995) rather than the typically addressed 16% of the population representing the innovators and early adopters. Changes in teaching strategies, rates of adoption, reasons for adoption, and actual implementation documentation for the mainstream majority of faculty populations were a central focus in the development of the model. This investigation proceeded based upon two assumptions adapted from those guiding the writing of Mehlinger and Powers (2002):

1. Technology is having an impact on how we teach and learn.
2. Technology is having an impact on the role and performance of higher education faculty.

Heeding the suggestions for future research (Kane, Sandretto, & Heath, 2002; Roblyer & Knezek, 2003), this study furthered the attention on how beliefs and practices influence the development of university academics as teachers. Central to the study is the inquiry into the processes that higher education faculty members use to adopt and implement technology. The resulting data were expected to inform the design of a technology integration process model that is relevant to higher education's unique culture and that would optimize mainstream faculty members' adoption-decision-implementation processes.

Previous models for instructional design, professional development, and technology integration were developed to inform processes for learning technology,

training, and technology integration strategies. Few reviewed were specific to a university faculty audience. The conceptual model (Figure 3.1) incorporates instructional design

Figure 3.1 Conceptual technology integration process model

principles of design, development, and implementation through the study constructs of Instructional Design and Instructional Delivery. The constructs, Peer Support and Institutional Support, were included in the conceptual model upon realizing the contribution of previous professional development model components such as establishing rationale for learning and for on-going peer support. Previous technology integration models lent credence to the inclusion of constructs, Student Use and Learning Process, through their emphasis on teaching and learning factors in the technology integration process.

The purpose of the study guided the development of the model, as well. There was interest in developing a model related to the factors encountered by higher education

faculty that reflected the patterns, motivation, and emphases used by those faculty members in the adoption and usage of technology in teaching and learning. The model's framework addresses a linear progression of factors that influence faculty members' decisions to ultimately make changes to their teaching and learning with the involvement of technology.

This model is divided into four conceptual parts. The first part of this model focuses upon the support systems available to and used by the faculty member within the technology integration process. Institutional professional development opportunities, institutional-provided resources in the form of physical resources and incentives, and peer support form the three segments of this section. The availability and use of these components appears to be linearly related to the motivation of faculty members to enter the technology integration journey, as well as the instructional design, delivery, and student use requirements determined by the faculty member.

The construct of Motivation is influenced by both general motivation components and specific motivation components. The general motivation consists of self-satisfaction and also the external requirements upon the faculty member by others. Students, the institution, or peers may instigate these requirements. Specific motivation involves two distinct value components. These consist of the value on perceived student learning and the value on instructional processes. The latter component of instructional processes is conceptually created by a value on instructional delivery, value on instructional design, and a value on collaboration. These form a conceptual background for instructional processes, but are not included on the model diagram due to space and readability constraints.

The motivation involved in the technology integration process influences a faculty member's planning and design strategies when preparing instructional materials, presentations, or entire courses. The design of instruction seems to be directly related to the content delivery and the level of student use of technology required by the faculty member. These constructs (Design, Delivery, and Student Use) form the third conceptual part of this model.

The impact or outcomes represented within this conceptual model are centered upon perceived student learning. A faculty member's perception of technology's impact on student achievement and the learning processes within the classroom is a key component in reaching the ultimate goal of technology integration -- a positive increase in student learning. The faculty member's perceptions of enhanced student to teacher interaction, student to content interaction, and student to student interaction/collaborative learning could possibly influence faculty beliefs concerning the attainment of student learning goals.

This conceptual model complements prior professional development and technology integration models, but extends the framework by including the role of peer support, the specific values that play into motivation, and the perceptions of enhanced instructional interactions that might ensure successful achievement of student learning goals. This process of technology integration highlights the conceptualizations necessary for a university faculty member to internalize in order to travel along a continuum toward effective technology integration into teaching and learning.

The survey data gathered from faculty responses to indicators categorized by the constructs derived from the conceptual model provided a means to analyze correlations

between the constructs. The resulting bivariate correlations were used to test the model through path analysis. Inferences can be made regarding the strength of the paths between these constructs and what factors play a determining role in the development of a tertiary level faculty members' technology integration process.

Research Design

Rationale for Methodology

This exploratory study employed a mixed methodological approach utilizing a mixed model study design (Tashakkori & Teddlie, 1998). The quest for quantifiable data regarding perceptions, motivations, and experiential uses of technology demanded the use of a self-reporting survey with closed choice responses. The need for more in-depth information from mainstream faculty members prompted the inclusion of face-to-face interviews with selected participants meeting specified criteria. Certain aspects of the qualitative data were intended to be quantitized (Miles & Huberman, 1984), thus employing the techniques of methodological triangulation as well as data triangulation within this study.

Quantitative information obtained from the survey allowed data analysis using descriptive and inferential statistics. The data was analyzed and reported at the group level. This analysis provided for the generation of tables and graphs illustrating response frequencies, means, and standard deviations of key questions on the survey. Analyzed survey data directed the purposeful sampling of nine specific cases representing mainstream faculty members.

Qualitative methods were used to “permit inquiry into selected issues in great depth with careful attention to detail, context, and nuance” (Patton, 2002, p. 227). Using case

study methods via interviews allowed the researcher the opportunity to study unique differences and similarities, as suggested by Patton (2002), among the mainstream faculty in their process of integration of educational technology. The in-depth research conducted in the natural context provided data from a comprehensive perspective providing more detail to a panoramic view. The use of multiple cases enables the use of cross-case analysis to determine similarities and differences within the group represented. Yin (1994) credits Herriott and Firestone with noting that evidence from multiple cases often causes a study to be more robust.

The use of mixed methods within this study permitted the gathering of data that was complementary to the posed research questions. Both survey and interview data offered a means to address the investigation of factors, processes, roles, benefits, and changes as set forth in the questions guiding this study. The analysis of the combination of quantitative and qualitative data facilitated the ability to make inferences about mainstream faculty members' processes of adopting and implementing technology in teaching and learning.

Assurances of Data and Design Quality

As this study made use of a mixed methodology approach, the issues of construct validity of the survey, internal validity of the resulting inferences, and the credibility, transferability, dependability, and confirmability that make up the trustworthiness of the qualitative portion of the study are addressed.

Yin (1994) purports the need for construct validity assurances in addition to internal and external validations. Clear definitions for constructs, such as, peer support and motivation for adopting or implementing instructional technology, are necessary so that the

survey development centered upon the correct interpretation of these concepts.

Recognizing the need for content validity of instruments places emphasis on the necessity of the instrument truly measuring what it was intended to measure. A small group panel that reviewed the instruments prior to dissemination checked both construct and content validity. More details on this procedure are included in the section in this chapter entitled Instruments.

Lincoln and Guba (as cited in Tashakkori & Teddlie, 1998) introduced the concept of “trustworthiness” as an analogous term for quantitative study quality issues. The four criteria of credibility, transferability, dependability, and confirmability must be combined to determine the trustworthiness of a qualitative investigation. The methods used within this study to ensure that each of these criteria was addressed involved triangulation and member checks where participants were asked to check the interpretative conclusions of the researcher.

This study sought to inform the development of a technology integration process model which could be extended to other cases as suggested by Maxwell (1996). The transferability of this study was enhanced by the accurate and detailed descriptions of the participants and the context in which the data were collected and analyzed.

Using the method of triangulation allowed “opportunities for deeper insight into the relationship between inquiry approach and the phenomenon under study” by analyzing consistencies and inconsistencies across these data (Patton, 2002, p. 248). This combining of methods of data collection strengthens a qualitative study and augments the possibility of “internally valid or trustworthy conclusions and inferences” (Tashakkori & Teddlie, 1998, p. 91).

The data obtained from the survey and the rich detail obtained from interviews were corroborated and concurrently analyzed to check the validity of the findings. Coding procedures adhered to research-based coding categories and were checked for consistency. The multiple data-collection methods assisted in eliminating biases that might result from relying upon single data sources or single methods of analysis.

Two of the four types of ethics, identified by David Flinders (as cited in Gall, Borg, & Gall, 1996), that could be relied upon to assist in resolving issues in case study research were utilized as guiding ethical practices. Deontological ethics addresses basic values such as honesty and respect for others. The adherence to relational ethics requires that “the case study researcher be a sensitive, fully engaged member of the participants’ community rather than a detached observer” (Gall, Borg, & Gall, 1996, p. 556). The study reflected an emic perspective with the researcher as a peripheral participant observer exhibiting competence, thoroughness, and integrity throughout the study duration. There was full intent in this exploratory study to accentuate the positive aspects of the participants’ adoption patterns in using technology in teaching and learning. Respect for all participants, regardless of adopter level categorization as set forth by Rogers (1962), was a preeminent aspect of this study.

All efforts were made to achieve a desired level of confidentiality for the study participants. Specific organizational details were masked in an attempt to ensure anonymity of the faculty participants, yet not detract from the contextual importance of the study. A Doctoral Research Study Consent Form (Appendix C) was obtained from survey respondents. Pseudonyms were utilized in all identifying instances. Interview procedures ensured that no information concerning other cases was revealed to other interviewees.

Setting

This study was conducted at a prominent Research I university in the southern section of the United States. The university's mission is the generation, preservation, dissemination, and application of knowledge and cultivation of the arts. Aspiring to a nationally acclaimed flagship status, the university is focusing on actions that increase research and scholarly productivity and the quality and competitiveness of the undergraduate and graduate students (LSU Quick Facts Website, 2005).

The student body exceeds 31,000 students and full-time and part-time faculty members number over 1300 (LSU Quick Facts Website, 2005). The LSU Faculty Handbook (1997) emphasizes the comprehensive components of teaching, research, and public service for faculty members. The nine academic colleges and three schools form distinctive university units that operate within their own unique cultures, organizational procedures, and theoretical beliefs. Their commonality lies in the pursuit of excellent teaching, productive research agendas, the creation of scholarly work, and the preparation of future educators, albeit at varying levels of intervention.

Population and Sampling Methods

As all faculty members are responsible for the education and preparation of possible future teachers, counselors, and administrators through content or pedagogy, these university educators comprise the population for this study. Purposeful sampling encompassed the full-time and part-time faculty members from the colleges of arts and sciences, basic sciences, and education (Figure 3.2).

Survey Participants

The unit of observation and analysis was university faculty members. The sampling strategy used for survey participants was purposive sampling (Tashakkori & Teddlie, 1998). The purposive sampling strategy emphasizes the formation of in-depth

Figure 3.2 Research participant sampling

understanding that leads to the illumination of the research questions under study (Patton, 2002). The colleges were selected based upon their participation in the preparation of future educators through the teaching of content and pedagogical courses. The study survey was administered to full-time and part-time faculty members ($N = 764$) within the

three colleges who were employed during the Spring Semester 2005. This participant list originated from faculty rosters obtained from the respective college websites and the current campus directory.

Interviewees

Using a stratified nonrandom sampling strategy for interviewee selection, nine individual cases were selected from all survey respondents meeting two criteria. The stratified nonrandom sampling strategy (Tashakkori & Teddlie, 1998) involves the selection of cases “nonrandomly (volunteer, available, and so on) from each subgroup of the population under study” (p.76). The first criterion was a self-selected technology integration process stage as per Faculty Survey Instrument (Appendix A) demographic question number 11 (either of the stages: Awareness, Learning the Process, Understanding and Applying the Process, Creative Application to New Contexts). The second criterion was the inclusion of their email address at the end of the survey. The inclusion of the email address reflected their permission to be included in the pool of possible interviewees based upon the wording of the last survey question, “My current email address is: (optional for entry into Amazon.com gift certificate drawing OR if you would consider being interviewed within this study)”. All survey respondents meeting the criteria were contacted via email for a possible interview. Fifteen responses were received and the nine final cases were selected based upon representation of the three colleges and face-to-face availability. Sample distribution details follow in the Study Data Collection section of this chapter.

Instruments

Development

This inquiry utilized two research instruments created by the researcher using original entries and adaptations from existing instrument items. The development of the survey and interview protocol was based upon the research questions for this study, the focus topic areas of a technology integration process, relevant literature, and existing instruments. The survey instrument was adapted from others in order to add to a cumulative tradition of research.

Based upon instructional design models and technology integration models referenced previously, this study sought to discover information regarding key steps in the technology integration process. Results from this research have led to the development of a technology integration process model meant to inform the design and implementation of technology integration professional development opportunities for university faculty members. It was hypothesized that this process involves these focus constructs:

- Motivation
- Peer Support
- Institutional Support
- Institutional Resources
- Designing Instructional Activities
- Delivering Instruction
- Requiring Student Use of Technology
- Evaluating Instructional Benefits

Using these constructs along with the necessary component of demographic information, a draft survey was developed.

Seeking to assemble an inclusive instrument, comparative information was compiled from ten previously used survey instruments. Their selection was based upon the similarities to this proposed research design, the structure of the items, and their target audience. Attention was paid as to whether statistics concerning internal consistency reliability were included in the documentation. Two instruments developed within the research conducted at the Institute for the Integration of Technology into Teaching and Learning at the University of North Texas, as reported by Knezek, Christensen, Miyashita, and Ropp (2000) yielded statistics. The “Faculty Attitudes Toward Information Technology” instrument was reported to have scale reliabilities across a seven-factor structure ranging from .74 to .98. The “Stages of Adoption of Technology” (Christensen, 1997) is a single item survey and provided a test-retest reliability estimate of $r = .91$. Other instruments reviewed for this proposed study revealed no accompanying statistics.

All but one of the instruments reviewed had a higher education focus. The case study instruments developed by Lynch, Bober, Harrison, Richardson, and Levine (1998) were designed for a grant evaluation involving K-12 classroom teachers. Through its mixed format of multiple choice and open-ended response, it provided guidance in the development of survey items on perspectives, barriers, and proficiencies. The Learning with Technology Profile Tool (North Central Regional Educational Laboratory, 1997) has no stated focus area but is applicable to all educators. The central premise of this instrument is to develop a profile of current instructional practices with regard to indicators of engaged learners.

Another multi-level focus instrument, The Level of Technology Implementation (LoTi) scale, was developed by Dr. Christopher Moersch in 1994. It has been used in a variety of doctoral studies, as documented in a Moersch (2001) journal article. This instrument revolves around the framework categories of implementation levels of Nonuse, Awareness, Exploration, Infusion, Integration (Mechanical), Integration (Routine), Expansion, and Refinement. The version for Higher Education Faculty, version 4.0 (Learning Quest, 2003) is designed using 8-point Likert responses on fifty questions. The questionnaire is not categorical and provides a varying mix of topics. The purpose of the questionnaire is stated such that it will provide assistance to educational institutions in making choices regarding staff development and future technology purchases.

The higher education focused instruments varied from Likert scales of agreement, forced choice, open-ended response, and a mixed format. Jacobsen (1998a) constructed an extensive 195 item multi-segment mixed format survey instrument used in her dissertation studying the innovators and early adopters among university faculty. She surveyed for patterns of computer technology use, experience, software and tool usage, self-efficacy, demographic information, changes to teaching and learning, incentives, barriers, preferred learning methods concerning technology, methods of integrating technology, and evaluating the outcomes of using technology for teaching and learning. These categorical areas are important to obtain the information necessary for the generation of a mainstream faculty profile of educational technology use.

The characteristics and profile generation of mainstream faculty do not make up the central foci of this study, so, additionally; survey information was needed to generate data concerning the role of informal membership in communities of practice on the adoption

and implementation of technology innovations. A questionnaire developed by Durrington, Repman, and Valente (2000) asked for actual nomination data using a roster technique. While this study did not seek specific names of colleagues, questions were included regarding people from whom participants seek advice or collegial discussion.

The MTSU survey (Lea, Clayton, Draude, Barlow, 2001) devised and disseminated a four-section instrument requesting information from all full-time faculty members. The results on instructional technology across campus informed additional measures for improving educational technology resources and services for faculty members and students. Both Finley and Hartman (2004) and Adams (2002) created instruments for use within the colleges of education at their respective institutions. Finley and Hartman interviewed innovators and included survey questions concerning the university culture, teaching styles, skills and knowledge, and vision and pedagogy. Adams (2002) examined teachers' concerns related to technology integration into teaching and compared these with demographic variables. Her 8-point Likert instrument contained statements that allowed response by non-users.

Most technology integration surveys and questionnaires are designed to reveal usage frequencies and patterns among users. They tend to target the innovators and early adopters in an attempt to establish what is being used and how by those who are eager to adopt innovations. In an analysis of survey items, this researcher has noted that often the items request information in such a way as to belittle or lessen the importance of responses by those slow to adopt. Respondents can receive negative connotations or feel that they are being negatively labeled as a result of non-use or slow adoption of technology. In an attempt to address this observation, the survey questions for this study were designed to

elicit responses from participants concerning technology adoption, but worded such that all steps toward technology integration, regardless of size or importance are accentuated.

Following this comparative examination, the process began of developing a draft survey. The need for a new survey instrument was made evident during the review of current literature. This research required a data collection tool that would extract information concerning faculty participation in communities of practice and the process of technology integration into teaching and learning. Previous instruments contained essential components, but were not as process-oriented as this study required.

Aligning key phrases from the instruments with the stated technology integration process steps, a mixed format instrument began to emerge. Using 5-point Likert scales, forced choice, and open-ended response, the survey questions were formulated and then subjected to critical item-by-item scrutiny. The Likert response scale is: 1= Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree, 5= Strongly Agree.

The panel of experts examined the instrument for content validity, wording of questions and statements, and length of the instrument. Categories were collapsed and questions re-worded over multiple iterations. The final version contains the categories of General Perspectives, Barriers to Technology Integration, Motivation for Technology Integration, Goals for Technology Integration, Resources, Design, Implementation - Delivery, Implementation - Student Use of Technology, Results, and Demographic Information. The self-reporting Faculty Survey Instrument (Appendix A) contains 108 questions designed to elicit information as needed to address this study's research questions.

Once the survey items were finalized the survey was converted into an online Java scripted format with a relational *MySQL* database. The Survey Cover Letter (Appendix B) was sent by the researcher to selected email addresses from an administrator's web screen within the password-protected program. Each email address had an associated instance of the survey which was appended to the end of the cover letter.

The Faculty Interview Protocol (Appendix E) is comprised of prescribed questions based upon the general topic areas and constructs of the survey. Seeking to ensure that the interviewees addressed particular topics, a protocol was used to guide the interview. To that means, the protocol for this study was specifically designed to obtain in-depth information concerning the how and why of technology integration innovation adoption by mainstream faculty members. A total of fourteen questions were included on the protocol. Sample questions from the instrument are "How would you describe your process along the journey of technology adoption and implementation in teaching and learning?" and "What do you feel is the most significant factor that augments your ability or desire to adopt and implement a technology innovation?" The development of this instrument was inextricably tied to the survey in order to ensure accurate triangulation of data.

Pilot Study

To determine if the survey items were understandable by the participants and if the internal consistency reliabilities were satisfactory, a pilot group was emailed the online survey link upon receipt of the Institutional Review Board Approval Form (Appendix G). Using the email list, organized by college, of faculty members from the three targeted academic units, every fourth email address was selected to be sent the online survey. The survey link was appended to the bottom of the email cover letter and upon clicking the

survey link, the participant was directed to the online consent form. Clicking the “Take me to the survey” button at the end of the form indicated consent and sent the respondent to the first section of the Faculty Survey Instrument Online Version (Appendix D). Each section of the print survey comprised a single web page of the online version where the 5-point Likert scale items were listed and radio buttons allowed the respondent to select their desired response. There was opportunity for respondents to begin the survey, close out, and then resume the survey by simply clicking on the link within their email again. Several participants emailed that this was a desirable feature of the survey. Upon reaching the end of the survey, clicking the Next button sent the respondents to a thank-you page indicating that their email address would be entered into a random drawing for one of five \$25.00 Amazon.com gift certificates. The Submit Survey button produced the last page indicating that survey responses had been submitted and there could be no alterations at this point.

Thirty-one participants replied and a *Microsoft Excel* spreadsheet was generated containing the data entered by the respondents. Data were entered into the statistical program, Statistical Package for the Social Sciences (SPSS, 2003). Variables were created and Likert scale survey items related to barriers (Questions 2a through 2o) were reverse-scaled so that all items shared the same scale directionality. Statistical analyses were conducted for internal consistency estimates of reliability on each of the constructs guiding this research study. The constructs were analyzed according to their associated survey items to compute a coefficient alpha statistic for each. The construct of Instructional Delivery revealed a poor reliability estimate of 0.165. Iterative inspections of the survey questions revealed the need to rescale Delivery Question 1 (“I use lecture in my class

almost exclusively.”) as it appeared to be in opposition conceptually with the other questions in the series.

Study Data Collection

Survey

Official data collection began by disseminating the researcher-designed field-tested survey via email to the remaining email list plus the pilot non-respondents (N = 733). Suggested submission dates for each of the email mailings were of a one-week timeframe. A total of seventeen emails were deleted from the possible list following requests for removal and returned emails due to inactive mail accounts. Two automated replies were returned indicating that the faculty members do not use email and would prefer contact by means of the telephone. This prompted the send of paper copies to each of those faculty members along with those who encountered link difficulties. Print copies were placed in the physical mailboxes of the College of Education faculty members. A total of forty-two (42) paper copies were distributed. The electronic version of the survey was sent for a second time to all non-respondents. A third and final dispersion was conducted in mid-May.

Interviews

Individual cases were selected based upon survey responses and college affiliation while seeking a representative mix from the three targeted colleges. Of the nine representative cases selected, each interview encompassed focused questions developed by the researcher and designed to probe more deeply into opinions, feelings, beliefs, and practices of the technology integration process experienced by mainstream faculty members. Access to the participant’s perspectives through interviews allowed the study to

reveal how the participants interpret the concept of technology integration and how their understandings influence their behaviors (Maxwell, 1996).

The interview followed an interview guide approach using the Faculty Interview Protocol (Appendix E). Yin (1994) advocates the use of interviews as a means of providing perceived causal inferences. The interview questions were formulated to ensure that appropriate inferences could be made and that information could be triangulated with survey data. Following suggestions from Spradley's (1979) Developmental Research Sequence, the interview involved a variety of questions, which allowed conversational format, the restatement of terms as needed, and the creation of hypothetical situations required for understanding the question. Scheduling was achieved via email and appointments were made at the convenience of the participants. Final distribution of the interviewees was comprised of three from the College of Education, four from the College of Arts & Sciences, and two from the College of Basic Sciences.

The nine selected cases were interviewed individually in a face-to-face setting with each interview lasting approximately thirty minutes. Emergent questions were included in the interview in accordance with the interview-guide approach. The interviews were digitally recorded with participant permission, files transferred to a computer, transcribed verbatim via the use of an installed media player and word-processing software. The verbatim data provided direct quotations that illuminated participant perspectives and were easily extracted for inclusion. These interviews enabled further identification and description of the technology adoption process across mainstream faculty members at the university level.

Anonymity issues were addressed by the removal of identifying information, masking identities within the interview content, and the use of pseudonyms where appropriate. Regardless of precautions, the identity of the participants could still be recognizable due to their descriptions or comments. Interview transcripts were provided to participants via email for validation and approval. There were no returns for corrections.

Methods of Analysis

Survey Data Analysis

Survey data obtained in *Microsoft Excel* format from the online database program hosting the study survey were formatted and entered into SPSS (2003). Recoding issues were previously addressed with pilot data. Data were sorted by Self-Selected Stages Within the Technology Integration Process (Appendix F). All stage 5 participants (indicating the most advanced stage in the process - Facilitating the Process) were removed from the data set. Mean variables were created and final data were summarized using descriptive techniques. Frequencies and descriptives among gender, faculty position, self-selected technology integration process stage, class sizes, and use of technology-equipped classrooms were calculated. Means and standard deviations were computed with the intent to reveal response patterns created by faculty members within survey indicators. Zero-order correlations between construct variables were computed for entry into the path analysis software program for subsequent testing of the Conceptual Technology Integration Process Model (Figure 3.1).

Interview Data Analysis

The interview data were analyzed using interpretational analysis (Gall, Borg, & Gall, 1996) that allowed the revealing of constructs, themes, and patterns used to explain

the phenomenon under study. The unitizing, categorizing, and subsequent coding provided a methodical way of organizing data for analysis. A constant comparative analytical scheme (Glaser and Strauss, 1967) was used to analyze qualitative data obtained from responses in the interviews. The information derived from the interview data was unitized and an iterative process followed for defining the categories. This ensured that each category set was internally consistent and mutually exclusive (Lincoln & Guba, 1985), thus exhibiting external heterogeneity.

The transcribed interview data was entered into the Atlas.ti software program (Scientific Software Development, 2004). This visual qualitative data analysis tool provided a means to segment documents into quotations and to define codes. The graphical networking feature allowed the creation of a visual representation of concept relationships. Using Bogdan and Biklen's (1982) coding categories in conjunction with the research study constructs as a basis, the areas of setting, context, situations, events, activities, processes, strategies, relationships, perceptions, and perspectives were addressed. Interview data provided additional information to address the research questions posed in this study. Of particular note was the intent to reveal more about the role of communities of practice in mainstream faculty members' technology integration processes and their perceived changes in teaching behaviors as evidenced by the use of technology in teaching and learning.

Yin (1994) states that in order to achieve a high-quality analysis, the researcher must seek as much relevant evidence as available and will indicate all pertinent alternative perspectives, based upon current thinking, and the researcher's own prior, expert

knowledge. Collecting a complete body of evidence and iterative analysis enabled this researcher to reach the level of completeness necessary for the purposes of this study. The triangulation of survey and interview data assisted in establishing the validity of the data collected and assisted in arriving at possible responses to the proposed research questions upon which this study is based.

Model Analysis

The purpose of a structural equation model is to “provide a meaningful and parsimonious explanation for observed relationships within a set of measured variables” (MacCallum, 1995). Statistically, structural equation models are widely used because they provide a mechanism for taking into account measurement error in the observed variables and they also enable researchers to study both the direct and indirect effects of the various variables in a model (Raykov & Marcoulides, 2000). A frequently cited advantage of structural equation modeling is that it “requires researchers to think carefully about their data and to venture hypotheses regarding each variable” (Hoyle, 1995, p.14).

Path analysis shares similar processes and outcomes with structural equation modeling as both are causal modeling techniques. Path analysis is a technique used for the testing of hypothesized models consisting of manifest variables. Jöreskog (1993) noted the two components of a path model being the structural equation part which represents the theoretical relationships between constructs, and the measurement part of the model which defines the relationships between the observable indicators and the theoretical constructs.

The aphorism, ‘correlation does not imply causation’ (Everitt & Dunn, 1991) must be remembered when analyzing data using multivariate statistical methods involving correlation coefficients. Those researchers advise that “structural equation models are best

seen as a description of the investigator's belief about the causal structure of a set of variables of interest" (p. 272).

This research study posed a hypothesis concerning the testing of a conceptual model of the technology integration process that might be engaged in by mainstream faculty members. Path analysis was the chosen strategy in order to provide estimates of the magnitude and significance of hypothesized causal connections between sets of variables which would aid in discovering which paths are more important.

The technique of causal modeling called path analysis "uses multiple applications of multiple regressions to estimate causal relations, both direct and indirect, among several variables and to test the acceptability of the causal model hypothesized by the researcher" (Mertler & Vannatta, 2005, p. 14). The model generating approach (Jöreskog, 1993) was selected for this analysis. In this approach, a tentative model is first specified by the researcher and if found to not fit the given data, the model is modified and retested using the same data. "The goal may be to find a model that not only fits the data well from a statistical point of view, but also has the property that every parameter of the model can be given a substantively meaningful interpretation" (p. 295).

In this study, a testable model was first specified based on the conceptual model described previously in this chapter. The testable model (Figure 3.3) was developed for model testing and model generation. Bivariate correlation coefficients were obtained through analysis from faculty responses to survey indicators categorized by the constructs, Institutional Support, Institutional Resources, Peer Support, Motivation, Instructional Design, Instructional Delivery, Student Use, Learning Process, and Student Learning. The resulting correlation table was uploaded to the LISREL 8.7 (Jöreskog & Sörbom, 2004)

Figure 3.3 Technology integration process model - proposed paths

software program in order to obtain estimates of the free parameters from a set of observed data and to test the acceptability of the hypothesized causal model.

The resulting path diagram presented the paths between endogenous and exogenous variables and their relative strengths as indicated by the path coefficients in a graphical format. Direct and indirect effects were noted in the diagram and verified within the textual program output. The χ^2 statistic was evaluated for goodness-of-fit of the data based upon the criterion that the ratio between the χ^2 and df is < 2 (Ullman, 1996). The program computed other various fit indexes and the values were also evaluated to indicate acceptable fit of the model to the data. The 0.90 value for normed indexes as a reasonable minimum for model acceptance is widely used by social and behavioral researchers (Bentler & Bonett, 1980). Following the analysis it was determined, based upon included modification indices, to adjust the specified and estimated model by either freeing

parameters that formerly were fixed or fixing parameters that formerly were free. New pathways were added and the model was tested again. Evaluative methods were again applied and a decision was made concerning whether the data were fitted to the model.

Summary

Both quantitative and qualitative methodologies guided this research inquiry. These chosen methodologies, instruments, data collection procedures, and data analyses were pertinent to the illumination of information that shed light on the research questions posed. Two research instruments were validated and administered to research participants. The survey was disseminated in an online format with paper copies distributed as requested. The instrument provided quantitative data that was analyzed using appropriate statistical procedures and SPSS. Survey data provided tabulated correlation coefficients needed for entry into the LISREL structural equation modeling software program. A Conceptual Technology Integration Process Model (Figure 3.1) was tested using path analysis with resulting indices of fit. The interview protocol provided qualitative data suitable for entry into the Atlas.ti software program that utilized the constant comparative method of data analysis.

The methodologies and procedures within this study were used to add possible new dimensions to the understanding of the educational technology adoption process among mainstream university faculty members. This technology integration process was thoroughly explored and resulting information appears to aid in understanding the ‘how, when, why, and why not’ aspects of their decision to integrate technology into teaching and learning.

CHAPTER FOUR

RESEARCH RESULTS

This study was designed to reveal the voices of mainstream university faculty members concerning their perceptions, motivations, values, and usage of educational technology in their teaching and learning. Data from the quantitative survey were first analyzed for descriptives and bivariate correlations between constructs. Subsequently, the correlations were used to test a hypothesized model of the technology integration process in which mainstream university faculty engage. Qualitative interview data from nine cases were analyzed using the defined constructs as the basis for coding and categorizing.

The results of this research study are reported in the following subsections of this chapter: (1) descriptive characteristics of university faculty sample, (2) analysis of survey data, (3) analysis of path models, (4) interview data analysis, and (5) summary of results.

Demographics of the Sample

All Respondents

A total of 129 faculty responded to the survey. The overall response rate was 16.9 %, for pilot and study respondents. Data were analyzed for distribution concerning the self-selected stages of technology adoption and integration. This was conducted as a means of differentiating between those who consider themselves early adopters or very adept at the technology integration process and the mainstream faculty. The specific survey question with identifying stage descriptions is found in Appendix F. In the self-selection of a technology adoption stage, the largest percentage of respondents (36.4%) felt that they were in Stage 3 (Table 4.1). This stage reflects “Understanding and Applying the Process.” A descriptive example of Stage 3 provided on the survey is, “I use a variety of

technology resources/tools in my preparation, instructional delivery, and evaluation. My students use a variety of technology resources/tools in the construction of curriculum-based products.” The lowest stage on the scale of adoption and integration (Stage 1) is “Awareness.” The accompanying description is “I am aware of technology and have some basic skills but do not think I have sufficient expertise to use technology without assistance. I rarely require the use of technology by students to complete assignments.”

Table 4.1

Frequency Table of Mainstream Faculty Self-Selected Stages of Technology Integration ($N = 129$)^a

	Frequency	%	Cumulative %
Stage 1	13	10.1	10.1
Stage 2	33	25.6	35.7
Stage 3	47	36.4	72.1
Stage 4	24	18.6	90.7
Stage 5	12	9.3	100.0
Total	129	100.0	

^aRespondents who selected Stage 5 are included in this analysis only.

Approximately 10% of the respondents felt this stage description most closely matched their level of adoption.

Figure 4.1 illustrates the frequency of the stages represented in this survey based upon self-selection. This curve corresponds adequately with that of Rogers’ adopter categories (Figure 2.1). Adopter categories or stages are fluid and the choice of which stage one believes to be a part of is highly subjective. One can assume from the data that

the sample is similar to and representative of Rogers' (1995) distribution of adopter categories.

Those selecting Stage 5 -“Facilitating the Process”, which is the highest adoption and integration level on the scale, were removed from the data set. Once the ‘Stage 5’ respondents were removed from the data, the remainder of the survey analysis took place on the remaining 117 cases comprised of mainstream faculty members.

Figure 4. 1 Distribution of self-selected stages of technology integration
Note. Stage 5 (Facilitating the Process) participants were included in this analysis only.

The purpose of this study was not to differentiate between categories of technology users, but was intended to reveal a much clearer picture of the process that mainstream university faculty members go through when adopting and implementing technology in

their teaching and learning. By identifying some influential factors that play into that process, professional developers might utilize the findings to create professional growth opportunities for this mainstream group that will address their needs in journeying along the technology integration path.

Study Sample

Table 4.2 displays the participants in terms of their gender and faculty rank for the 117 cases analyzed. Approximately two-thirds of the respondents were male (60.7%) with the larger segment of the group ($n = 26$) holding the rank of professor. The females accounted for slightly over one-third of the total (39.3%). The rank of Full Time Instructor was the largest represented among the females ($n = 16$).

Table 4.2
Frequency of Mainstream University Faculty Rank by Gender ($N = 117$)

	Prof	Assoc	Asst	FTI	PTI	Totals	
						<i>n</i>	Percent
Female	7	11	11	16	1	46	39.3%
Male	26	16	20	8	1	71	60.7%
Total Ranks	33	27	31	24	2	117	100.0%

The percentages of respondents from the respective colleges of Arts & Sciences, Basic Sciences, and Education reflect the size of the faculty within those colleges. Arts & Sciences had the most faculty members of the three groups. That college is comprised of the departments of Aerospace Studies, Communication Studies, English, Foreign Languages and Literature, French Studies, Geography and Anthropology, History, Mathematics, Philosophy & Religious Studies, Political Science, Psychology, and Sociology. The College of Basic Sciences houses Biological Sciences, Chemistry,

Computer Science, Geology and Geophysics, and Physics & Astronomy. In contrast is the College of Education with three departments of Curriculum & Instruction, Educational Leadership, Research, and Counseling, and Kinesiology. The distribution of faculty within these colleges by rank and gender is presented in Table 4.3. The College of Arts & Sciences composed 41% of the respondents in this study. Males participants were almost double the female participants from that college (male, $n = 31$ and female, $n = 17$).

Table 4.3

Frequency of Mainstream University Faculty Members' Rank by Academic College
($N = 117$)

		gender totals within colleges	Prof	Assoc	Asst	FTI	PTI	Total	
								n	Percent
A&S			15	7	11	14	1	48	41%
	F	17							
	M	31							
BASC			11	11	10	2	1	35	30%
	F	7							
	M	28							
EDUC			7	9	10	8	--	34	29%
	F	22							
	M	12							
Total			33	27	31	24	2	117	100%

The distribution by rank varies by college. The College of Arts & Sciences reflects a rather equitable distribution across full-time ranks. The College of Basic Sciences contributed 30% of the study participants with their total number of 35 being virtually equal across the ranks of professor, associate professor, and assistant professor ($n = 11$, $n = 11$, and $n = 10$). The design of this study was to gather data from the mainstream faculty, but also to encompass the colleges that provide the content instruction for pre-service teachers in the College of Education. The respondents in this study reflect a

comprehensive distribution of participants across gender, rank, and college representation. The demographic data from the survey reflect similar percentages of full- and part-time faculty in both male and female gender categories to university data obtained from the university website. The comparison between overall campus faculty and the study sample is provided in Table 4.4. Female full-time employees comprise 33.7% of the university faculty. The female full-time faculty respondents comprise a comparable 39.3 % of the sample total analyzed. The male full-time faculty across campus at 63.5% compares with the study sample of the same category of participant at 59.8%. It appears that the study sample reflects the make up of the campus population.

Table 4.4
Comparative Distribution of Faculty by Gender
and Employment Status

	Overall Campus		Study Sample (N= 117)	
	<i>N</i>	%	<i>N</i>	%
Female				
Part-Time	34	2.6	1	0.9
Full-Time	407	31.1	45	38.5
Total	441	33.7	46	39.3
Male				
Part-Time	37	2.8	1	0.9
Full-Time	830	63.5	70	59.8
Total	867	66.3	71	60.7
Total	1308	100%	117	100%

Note. Overall Campus data from LSU Fall Facts 2004 brochure

Table 4.5 indicates that 45% of the respondents teach medium-sized classes of 31 – 80 students and 25% teach large classes of more than 81 students. The total number of courses taught by the study sample was 161.

Table 4.5

Frequency Table of Mainstream Faculty Reported Average Class Sizes and Total Courses Taught ($N = 117$)

Average Class Sizes	Faculty	
	Faculty Teaching per Class Size	%
Small (1 - 30)	34	29
Medium (31 - 80)	53	45
Large(≥ 81)	30	26
	$N=117$	100%
Total Courses Taught		161

Figure 4.2 graphically illustrates the ranges of time when faculty respondents first began using technology in preparation or class presentation and also when they first began requiring their students to use technology for course assignments. The figure displays the

Figure 4.2 Timeframe for technology use origination

frequency results of those two statements. The time frames were listed as 6 months, 1-2 years, 3-4 years, 5+ years and not applicable. This last choice provided a means to record non-use as well. The two vertical bars at the 5+ years category illustrate a large difference in those using technology for their professional work, but at the same timeframe of 5+ years, almost half the number were requiring the use of technology for student assignments. The $n = 26$ value for the Not Applicable category for requiring technology use of students could indicate chosen non- use, or disciplines and courses that faculty members see as not having a clear technology rationale for technology use.

The following sections of this chapter will present descriptive statistics of the survey data, the analysis of the tested path model, and the analysis of interview data.

Descriptive Statistics of Survey Data

A copy of the Faculty Survey Instrument is included as Appendix A. Items were reorganized according to the constructs for analysis. The following questions were removed from analysis: Question 16p in the Barriers section, question 14n in the Goals section, Question 1a in the Design section, General Perspectives a, d, h, i, j, and Implementation - Delivery a, b, and c. Each survey item, other than the demographic questions, was designed to elicit level of agreement along a 5-point Likert scale. The scale design was: 1= Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree, 5= Strongly Agree. All questions in the Barriers section of the survey were re-scaled so that all questions would be in the same positive scale. Table 4.6 presents the descriptive statistics of all items representing each construct. Means with a value of 3.5 or higher indicate a mid- to high level of agreement on the indicator.

Table 4.6
Means and Standard Deviations of Survey Indicators

Overall Motivation (motiv_all)		<i>M</i>	<i>SD</i>
1.	Technology integration into teaching and learning is very important for my students.	3.85	.949
2.	Effective technology integration can be a positive change agent in student learning within my discipline.	4.09	.689
3.*	Technology integration efforts are not important for my tenure and promotion process.	2.53	1.119
4.*	The course I teach does not lend itself to technology integration.	3.94	.854
5.	Technology integration benefits my students.	4.00	.731
6.	I am personally gratified from learning new technology skills and strategies.	3.83	.868
7.	I see technology in teaching as a welcome challenge.	3.58	.940
8.	Technology integration in teaching results in recognition among my peers.	2.62	.917
9.	I received student requests to incorporate technology into my teaching.	2.41	1.043
10.	I received administrative requests to incorporate technology into my teaching.	2.44	1.078
11.	I am following an inevitable educational trend.	3.47	.988
12.	Through the use of technological tools, I am able to present more complex work to my students.	3.38	1.041
13.	Through the use of technological tools, I expect an increased level of collaboration among my students.	3.28	.972
14	Through the use of technological tools, I am better able to tailor students' work to their individual needs.	2.96	.923
15.	Through the use of technological tools, I will spend less time lecturing to the entire class.	2.75	1.090
16.	Through the use of technological tools, I will spend more time working with smaller groups who are pursuing project-based work.	2.86	1.074
17	Through the use of technological tools, I will spend more time preparing materials and resources for instruction.	3.64	.927
18.	Through the use of technological tools, my students will more fully master my course content.	3.40	.901
19.	Through the use of technological tools, my students will increase collaborative/communication skills.	3.25	1.025
20.	Through the use of technological tools, my students will show improvement in learning tasks, such as writing, analyzing data, or solving problems.	3.26	1.018
21.	Through the use of technological tools, my students will demonstrate a higher level of interest in the subject.	3.44	.904
22.	Through the use of technological tools, my interaction with students will increase.	3.32	1.039
23.	Through the use of technological tools, my students can work in an environment which appeals to a variety of learning styles.	3.44	.951
24.	Technology integration in my course provides a means of expanding and applying what has been taught.	3.71	.885
25.	I have changed my teaching style due to the use of technology into teaching and learning.	3.65	.977
Institutional Support (instsupp)			
1.	My knowledge and strategies of technology integration in teaching are primarily the result of institution-provided professional development.	2.39	1.098
2.*	I cannot depend upon readily-available tech support.	3.19	1.121

	Table 4.6 cont'd.		
3.*	There are limited institutional professional development opportunities at my university.	3.40	1.018
4.*	My university does not provide enough professional development opportunities that target the use of technology in instruction.	3.58	.967
5.*	There is little or no administrative support for the integration of technology into teaching and learning.	3.35	1.053
6.	I participated in shared-decision making concerning departmental technology adoption.	2.49	1.134
7.	My college/department provides access to instructional technology support.	3.56	.951
8.	Institution-provided workshops/seminars are very important to me as a source of information concerning integrating technology in my teaching.	3.03	1.114
9.*	I have attended approximately this number of courses/workshops/seminars on technical help or technology integration in 2004.	1.64	.825
Institutional Resources (instresc)			
1.*	I cannot depend on access to essential hardware.	3.43	1.053
2.*	I cannot depend on access to essential software.	3.31	1.110
3.	It is generally easy to obtain the resources I need for technology integration.	3.24	1.096
4.	It is easy for me to schedule the use of a technology-equipped classroom.	3.35	1.069
5.	I would participate more in technical or technology integration training with additional incentives offered.	2.65	.994
Peer Support (peersupp)			
1.	My knowledge and strategies of technology integration in teaching are primarily the result of informal collegial instruction or support.	3.08	.975
2.	I value dialogue with colleagues concerning effective technology-integrated teaching practices.	3.97	.860
3.*	There is little collegial sharing, discussion, or support in my department.	3.61	1.109
4.	I follow technology integration advice from a colleague.	3.19	.870
5.	I observed successful use of technology integration in someone else's class.	3.09	.969
6.	I would like to have greater interaction with other technology users to discuss common problems and/or teaching strategies.	3.23	.945
7.	I participate in an informal group or gathering in which discussions of the use of technology in <u>higher education</u> classroom teaching and learning take place.	2.22	1.043
8.	My colleagues' opinions about technology integration generally result in my making changes.	2.74	.959
9.	An informal network of friends/colleagues is very important to me as a source of information concerning integrating technology in my teaching.	3.26	1.123
10.	I use online communication with colleagues concerning the use of technology while preparing my course.	2.55	1.148
Design of Instruction Using Technology (design)			
1.	I have sufficient knowledge of a range of educational technology resources for effective classroom use.	3.22	1.092
2.	Innovative students are very important to me as a source of information concerning integrating technology in my teaching.	3.09	1.055
3.	I consider the use of technology when designing my course(s).	3.99	.689

	Table 4.6 cont'd.		
4.	I use general web-based tools (e.g., web page editor, Blackboard, Semester Book) when preparing my course.	3.74	1.199
5.	I use discipline area-specific technology tools when preparing my course.	3.31	1.141
6.	I use general multimedia technology tools (e.g., audio, video, image editing) when preparing my course.	3.27	1.311
7.	I use content-specific Internet resources (e.g., online tutorials, resource websites) within my discipline area when preparing my course.	3.40	1.189
8.*	While designing my course(s), I feel that the inclusion of technology requires too much of my time.	3.35	1.053
9.*	Technology integration into teaching and learning requires too much of my class preparation time.	3.34	1.027
Delivery of Instruction (delivery)			
1.*	I do not have enough personal technology skills to integrate technology into teaching and learning.	3.81	.964
2.*	Technology integration requires too much time within my course delivery.	3.60	.947
3.*	Using technological means (e.g. email, Blackboard email, etc.) to communicate with my students requires too much of my time.	3.92	1.076
4.*	I lack essential knowledge of how to effectively integrate technology into instruction to benefit student learning.	3.73	.979
5.	I use technology enhanced presentations (e.g., PowerPoint) regularly as a strategy for my class delivery .	3.32	1.357
6.	I use features within either Blackboard or Semester Book regularly to present content (e.g., posting lecture notes or resources) to my students.	3.36	1.411
7.	I use content-specific technology tools (e.g., probes, graphing calculators) regularly within my presentations during my class delivery .	2.49	1.142
8.	I use general multimedia technology tools (e.g., audio, video, image editing) regularly within my presentations during my class delivery .	3.15	1.295
9.	I use content-specific Internet resources (e.g., multimedia, databases) within my discipline area regularly within my presentations during my class delivery .	3.08	1.190
10.	I require the use of technology as an assessment tool in my class (e.g., online tests, CD-based tests, technology-produced paper, product, or presentation/demonstration.)	2.75	1.231
Student Use of Technology (stuuse)			
1.	I require the use of content-specific technology tools (e.g., probes, graphing calculators) by my students (either in class or for assignments) on a regular basis.	2.38	1.238
2.	I require the use of general multimedia technology tools (e.g., audio, video, image editing) by my students (either in class or for assignments) on a regular basis.	2.41	1.212
3.	I require the use of content-specific Internet resources (e.g., sites, databases, journals, tutorials) within my discipline area by my students either in class or for assignments on a regular basis.	3.16	1.306
4.	I require the use of online communication (e.g., Blackboard discussion, chat, email, interactive whiteboard) by my students to foster group collaboration in learning group discussion on a regular basis.	2.69	1.303
5.	I require student use of technology for authoring class papers.	3.19	1.189
6.	I require students to publish, post, or use technological presentation tools in class to present their projects.	3.08	1.321

	Table 4.6 cont'd.		
Impact of Technology on Learning Process (process)			
1.	I believe that my use of technology in teaching had a positive effect on student participation and feedback.	3.56	.978
2.	I believe that my use of technology in teaching had a positive effect on the interaction between myself and my students.	3.65	.931
3.	I believe that my use of technology in teaching has a positive effect on student interaction with other students.	3.37	1.031
4.	Technology use in my classroom encourages more student-centered learning.	3.21	1.038
Impact of Technology on Student Learning (stulrng)			
1.	I believe that my use of technology in teaching had a positive effect on student learning.	3.73	.805
2.	I believe that my use of technology in teaching had a positive effect on my students' depth of understanding of course content.	3.70	.931
3.	I believe that my use of technology in teaching had a positive effect on the depth and breadth of content covered in my course.	3.64	.987
4.	I believe that my use of technology in teaching had a positive effect on my students' use of higher order thinking.	3.21	1.038
5.	I believe that my use of technology in teaching had a positive effect on my students' use of problem-solving strategies.	3.24	1.006
6.	I believe that my use of technology in teaching had a positive effect on my students' ability to analyze data.	3.13	1.063

Note. Items marked with an asterisk were rescaled prior to analysis.

In relation to proposed research questions, this analysis revealed mean agreement levels between Neutral and Agree on the Likert scale. Institutional Support had two means of $M = 3.58$, $SD = .967$ on indicator 4 and $M = 3.56$, $SD = .951$ on indicator 7 that fell within this range. Both of these items indicate that the mainstream faculty members are in agreement that university-provided professional development and access to instructional technology support are important in the technology integration process. There was agreement on the ability to depend on access to essential hardware and software ($M = 3.43$, $SD = 1.053$ and $M = 3.31$, $SD = 1.110$) on indicators 1 and 2. The mean score for indicator 5 ($M = 2.65$, $SD = .994$) revealed the faculty members did not express agreement that additional incentives would entice them to participate more in technology training.

Indicator 2 on the Peer Support scale resulted in a high level of agreement for the statement, "I value dialogue with colleagues concerning effective technology-integrated

teaching practices.” With a mean score, $M = 3.97$, $SD = .860$, there appears to be a strong consensus on this collegial activity.

Within Motivation the two highest means were indicator 2 and indicator 5. Indicator 2 states, “Effective technology integration can be a positive change agent in student learning within my discipline.” This had a mean score of $M = 4.09$, $SD = .689$. This approaches Strongly Agree on the scale. Very closely related is Indicator 5, “Technology integration benefits my students.” The $M = 4.00$, $SD = .731$ score aligns with other mean scores to indicate a high level of agreement on the construct statements.

Student use of technology indicators did not yield similarly high mean scores as did previous constructs. Of six indicators, three (Indicators 1, 2 and 4) approached neutral ($M = 2.38$, $SD = 1.238$; $M = 2.41$, $SD = 1.212$; $M = 2.69$, $SD = 1.303$).

Positive effects of technology on the learning process of teacher-student interaction ($M = 3.65$, $SD = .931$), student participation and feedback ($M = 3.56$, $SD = .978$), and student-student interactions ($M = 3.37$, $SD = 1.031$) were indicated in the levels of agreement noted in the mean scores.

“I believe that my use of technology in teaching had a positive effect on student learning” and “I believe that my use of technology in teaching had a positive effect on my students’ depth of understanding of course content” were within 0.03 points of one another as the high mean scores for indicators 1 and 2 ($M = 3.73$, $SD = .805$; $M = 3.70$, $SD = .931$) of the construct of perceived Student Learning.

A survey item reliability analysis was conducted. The internal consistency estimate of reliability was computed and expressed as a Cronbach’s Alpha coefficient. Table 4.7

provides evidence that each survey construct met or exceeded the 0.70 level indicating satisfactory reliability.

Table 4.7
Survey Items Estimate of Reliability ($N = 117$)

Construct	Cronbach's Alpha	Total Indicators
Motivation	.916	25
Peer Support	.798	10
Institutional Support	.741	9
Institutional Resources	.805	5
Design	.700	9
Delivery	.713	10
Student Use	.740	6
Impact	.939	10
Total Variables	.953	84

Survey data revealed information concerning faculty usage of technology-equipped classrooms on campus. The question asked whether they teach in a campus classroom equipped with multimedia equipment. Response choices were 'yes, by choice', 'yes, by assignment', and 'no'. Figure 4.3 illustrates the response choices where $n = 77$ respondents said 'yes, by choice'. The "yes, by assignment" and "no" were virtually equal at $n = 19$ and $n = 21$ respondents.

Analysis of Path Model

Path analyses were conducted using LISREL 8.7 (Jöreskog & Sörbom, 2004). Table 4.8 presents the constructs in the hypothesized model and the manifest variables associated with these concepts. The constructs were measured from data obtained in the survey, with each set of indicators being carefully scrutinized for internal consistency. All of the variables are treated as measured manifest variables.

Figure 4.3 Technology-equipped classroom use

Table 4.8

Constructs and the Associated Variable Names

Constructs of Conceptual Model	Manifest Variables
Institutional Resources	instresc
Institutional Support	instsupp
Peer Support	peersupp
Motivation	motiv_all
Instructional Design	design
Instructional Delivery	delivery
Student Use of Technology	stuuse
Instructional Processes	process
Student Learning	stulrng

A series of bivariate correlations was computed to indicate the relationships among the variables (Table 4.9). The correlations were of the magnitude and direction that were anticipated in the conceptual stage of this study. It was hypothesized that peer support

Table 4.9

Bivariate Correlation Matrix for Variables Used in Path Analysis ($N = 117$)

	motiv_all	instsupp	instresc	peersupp	design	delivery	stuuse	process	stulrng
motiv_all	1.00	.456**	.229*	.517**	.611**	.484**	.556**	.712**	.681**
instsupp		1.00	.531**	.341**	.319**	.265**	.191*	.329**	.249**
instresc			1.00	.190*	.283**	.321**	.045	.190*	.293**
peersupp				1.00	.433**	.353**	.344**	.384**	.349**
design					1.00	.851**	.490**	.533**	.552**
delivery						1.00	.514**	.480**	.464**
stuuse							1.00	.652**	.525**
process								1.00	.789**
stulrng									1.00

* $p < .05$ ** $p < .01$

would be highly correlated with the aspects of instructional design and delivery. While those two correlations proved to be of a medium significance, peer support had additional medium significant relationships at the .01 level with all variables except institutional resources which was significant at the .05 level. Consistent correlation of peer support with other representative variables in the hypothesized model provided support for possible significant links in the path model to be tested against this data.

Other variables of importance in this study were the design and delivery of instructional technology and their relationship to learning process and impact of the use of technology on student learning. Both variables are significantly correlated with those variables of interest. Instructional resources showed no significant correlation to instructor required student use of technology, and exhibited a weak correlation of .190 significant at the .05 level with peer support and instructional processes. The strongest correlation in this data was between design and delivery with a .851 value significant at the .01 level. Based upon the hypothesized paths (shown previously in Figure 3.3) and the correlation matrix, appropriate directional program script equations indicating the intended paths between manifest variables were uploaded to the path analysis software program, LISREL 8.7 (Jöreskog & Sörbom, 2004).

The analysis was conducted to determine the causal effects among the variables Peer Support (peersupp), Institutional Support (instsupp), Institutional Resources (instresc), Motivation (motiv_all), Instructional Design (design), Instructional Content Delivery (delivery), Student use of technology (stuuse), Instructional Process(process), and perceived Student Learning (stulrng). The variables instresc, instsupp, and peersupp were

entered as the exogenous variables where their variability is assumed to be explained by other variables outside the causal model under consideration (Pedhazur, 1982).

The remaining variables in this model, *motiv_all*, *design*, *delivery*, *stuuse*, *process*, and *stulrng*, were entered as endogenous where it is assumed that their variance is explained by the model's exogenous variables. The anticipated significant paths were those related to Peer Support to Design, Delivery, and Motivation, and Instructional Design to Delivery. Instructional Delivery was hypothesized to have a significant relationship with Student Use, perceived Student Learning, and Instructional Process.

The initial model resulting from the maximum likelihood estimation procedure in the path analysis was not a good fit with the empirical data. The χ^2 value was 122.72 with $df = 13$. The Technology Integration Process Model - Tested Paths (Figure 4.4) displays the path coefficients resulting from each proposed path that was tested. In an effort to improve the model's fit to the data, four modification indices in the LISREL 8.7 output indicated that adding paths from Motivation (*motiv_all*) on Student Learning (*stulrng*), Student Use (*stuuse*), and Instructional Process (*process*) plus Instructional Process (*process*) on Student Learning (*stulrng*) would significantly improve the model. After reviewing these modifications from a theoretical standpoint, there appeared to be substantive justification for making these additions.

The error terms for the endogenous variables represent the variation and covariation in those variables that are left unaccounted for by the exogenous variables. MacCallum (1995) notes that these consist partly of both random error and systematic error that is not explained, but could theoretically be explained by variables not included in the model.

Figure 4.4 Technology integration process model - tested paths (TIPM - TP)

Following adjustments to the program script directional equations, the model was tested again. Figure 4.5 presents the resulting Technology Integration Process Model. In evaluating the output data for significant and insignificant paths, the critical values of 2.306 at $p < .05$ and 1.860 at $p < .10$ were used from the t -distribution table. Ten significant paths were identified at the .05 level and three significant paths were identified at the .10 level. These are indicated on Figure 4.5 with solid lines for the .05 level paths and dotted lines for the .10 level paths.

The number of free parameters which are comprised of the variances on the exogenous variables, the covariances around the exogenous variables, and all of the directional effects were reported in the program output. The R^2 values are reported for each of the endogenous variables and included on the path model. These serve as a reliability measure of the extent to which each adequately measures its respective underlying construct. As indicated in Figure 4.5 the value for Instructional Delivery indicates that the model can explain approximately 73% of its variance. Likewise,

Figure 4.5 Technology integration process model (TIPM)

Note. Only significant paths are included in the figure and are significant at $p < 0.05$, except the dotted lines representing the paths from Institutional Resources on Instructional Delivery and Instructional Design and Student Learning which were significant at $p < 0.10$. While not shown in the figure, in an effort to reduce the complexity of presentation, the covariances of the exogenous variables are not displayed.

approximately 60% of the variance in perceived Student Learning can be explained by the model and Learning Processes has approximately 61% of its variance explained.

The LISREL 8.7 program output provides t -values that determine significance of direct and indirect effects of exogenous variables on endogenous variables. Table 4.10 summarizes the significant and insignificant path coefficients for each endogenous variable. The largest total effect for each variable is notated in the table. There were 13 different significant direct effects on the six endogenous variables, Motivation, Design, Delivery, Student Use, Process, and Student Learning. Likewise, there were 18 significant indirect effects on these same variables.

Table 4.10
Summary of Causal Effects

Outcome	Determinant	Causal Effects		
		Direct	Indirect	Total
Motivation	Institutional Resources	-0.02	--	-0.02
	Institutional Support	0.33*	--	0.33*
	Peer Support	0.41*	--	0.41 ^a
Design	Institutional Resources	0.17**	-0.02	0.15
	Institutional Support	-0.06	0.17*	0.11
	Peer Support	0.15	0.22*	0.37*
	Motivation	0.52*	--	0.52 ^a
Delivery	Institutional Resources	0.12**	0.13	0.25*
	Institutional Support	-0.06	0.09	0.03
	Peer Support	-0.01	0.30*	0.29*
	Design	0.84*	--	0.84 ^a
	Motivation	--	0.44*	0.44*
Student Use	Institutional Resources	-0.16	0.08	-0.08
	Institutional Support	-0.02	0.15*	0.13
	Peer Support	0.05	0.27*	0.32*
	Design	-0.14	0.39*	0.25*
	Delivery	0.46*	--	0.46*
	Motivation	0.44*	0.13*	0.57 ^a
Process	Institutional Resources	--	-0.02	-0.02
	Institutional Support	--	0.21*	0.21*
	Peer Support	--	0.33*	0.33*
	Design	--	0.14*	0.14*
	Delivery	0.07	0.16*	0.23*
	Motivation	0.49*	0.22*	0.71 ^a
	Student Use	0.35*	--	0.35*
Student Learning	Institutional Resources	0.13**	- 0.01	0.12
	Institutional Support	--	0.19*	0.19*
	Peer Support	--	0.30*	0.30*
	Design	0.18	--	0.18*
	Delivery	-0.09	0.13*	0.04
	Motivation	0.23*	0.41*	0.64 ^a
	Process	0.45*	--	0.45*
	Student Use	0.05	0.16*	0.21*

* $p < .05$; ** $p < .10$

^a Largest total causal effect for corresponding variable

Peer Support was the key determinant to Motivation (.41) and Instructional Design (.37) as indicated by total causal effects. Peer Support posted significant total causal effects on all the variables in the tested model.

Motivation proved to be the determinant of the largest total causal effect on Design (.52), Student Use (.57), Process (.71), and perceived Student Learning (.64). As an outcome of primary interest, the remaining determinants of Student Learning as indicated by total causal effect were Peer Support (.30), Instructional Process (.45), Institutional Support (.19), Student Use (.21), Instructional Design (.19), Instructional Delivery (.04), and Institutional Resources (.11).

A variety of output indicators were used for evaluating the fit of the model to the data. This evaluation determines the degree to which the pattern of parameters specified in a model is consistent with the pattern of variances and covariances from a set of observed data. The Likelihood Ratio Test statistic, χ^2 , tests this closeness of fit between the two sets of data by measuring the discrepancy between the entered correlation matrix and the fitted covariance matrix. The desired value should approximate the degrees of freedom and it is generally reported that if the ratio between χ^2 and df is < 2 , the model is a good fit (Ullman, 1996). The Technology Integration Process Model (TIPM) overall fit statistics are $\chi^2 (8, N = 117) = 10.64, p < .22$, NNFI = 0.99, SMSR = 0.02.

Standardized residuals values were checked and there were none exceeding the 2.58 level that indicate a possible misfit of the model. Due to the sensitivity of the χ^2 value to large sample size, a variety of Goodness of Fit indices have been developed to address that issue and others. The values for Root Mean Square Error of Approximation (RMSEA), Confidence Interval - CI (RMSEA), Non-Normed Fit Index (NNFI), and the Standardized

Root Mean Square Residual (SRMR) were evaluated for both path models tested. The values are gathered for display and comparison in Table 4.11. Jöreskog (1993) notes that a generally accepted RMSEA value range for good fit to the data is .05 indicating good fit to .08 indicating reasonable fit. These values are associated with assessing the degree of approximation in the population by measuring discrepancy per degree of freedom.

Table 4.11
Overall Fit Information for Path Analysis

Model Tested	N	χ^2	<i>df</i>	χ^2/df	RMSEA	CI (RMSEA)	NNFI	SRMR
1. TIPM-TP	117	122.72	13	3.36	0.27	(0.23; 0.32)	0.63	0.12
2. TIPM	117	8.52	7	1.22	0.044	(0.0; 0.13)	0.99	0.02

The NNFI value of 0.99 exceeded the critical value of 0.95 and addresses the issue of model complexity. The SRMR value of 0.02 indicates a well-fitting model with the value less than 0.05. The value is interpreted as meaning that the model explains the correlations to within an average error of 0.02. These values individually and collectively indicate that the fit of TIPM to the data was good.

Analysis of Interview Data

In an attempt to provide informative detail to the analyses conducted in the quantitative segment of this study, interviews of mainstream university faculty members were conducted. The final question on the Faculty Survey Instrument (Appendix A) requested the optional inclusion of an email address for the purposes of providing contact information for a possible interview. The survey data was analyzed and 59 possible interviewees were delineated. The distinguishing factors used to select possible

interviewees were the exclusion of part-time instructors and those selecting five or more years of required student use of technology. These factors were viewed similarly to outliers in terms of experience. It was a strong intent to interview those truly representing the mainstream faculty member.

The selected participants were contacted via email and asked if they would consider a face-to-face interview and a copy of the Faculty Interview Protocol (Appendix E) was provided as an attachment for their perusal. Twelve responses were received and nine interviewees were selected. Appointments were arranged both through email and by phone. The purposeful sampling brought together 8 males and 1 female with 3 representatives from the College of Education, 4 from the College of Arts & Sciences, and 2 from the College of Basic Sciences. Their professional ranks ranged from full-time instructor to alumni professor (3 professors, 2 associate professors, 3 assistant professors, and 1 full-time instructor). These faculty members averaged 16 years experience.

All but two of the interviews were conducted in the offices of the interviewee. The remaining two were held in the researcher's office at the request of the interviewees. Permission was obtained for digital recording privileges prior to the start of the interview. Using the Faculty Interview Protocol (Appendix E), the questions followed in sequential order with additional probing questions or emergent questions inserted as needed or as arose. The interviewees provided in-depth responses and each interview lasted approximately 25 minutes. The digitally recorded files were downloaded onto a computer in audio file format where they were manually transcribed into a word processing document. The document files were loaded into Atlas.ti (Scientific Software, 2004) as primary documents.

Using the study constructs as a basis for coding, the interview documents were analyzed within that framework while attempting to triangulate data findings from the survey analysis. The research questions and the interview questions both contributed to the analysis framework for the interviews. Emergent themes were noted and coded appropriately. Using an interpretational analysis approach (Gall, Borg, & Gall, 1996), the interview data was examined iteratively to find evidence of constructs and themes that could be used to describe and explain the topic under study. These constructs represent the proposed factors included in the conceptual technology process model and in the organizational structure of the interview guide questions. Of the 37 original codes used to segment the data, 11 remained after collapsing categories. The data presented in Table 4.12 assist in seeing the constructs more readily addressed by the interviewees. It was decided to break out the codes, Reason to Use, Reason Not to Use, and Other Barriers due to the large number of codes for each of those categories. Motivation consists of a set of more general statements and phrases concerning the motivation to adopt and implement technology. In analyzing the study data, barriers were embedded within constructs of the survey data with a controlled number of items. Within the interview data, barriers emerged individually. It was decided to group them into categories within the Motivation construct for the purpose of analysis and discussion.

The interviews revealed the perceptions of a cross-section of faculty members from a variety of disciplines, a variety of years of teaching experience, and a variety of faculty ranks. The frequencies in Table 4.12 illustrate the prevalent topics of conversation from faculty members regarding the integration of technology. Following motivation, the second most prevalent topic that emerged from the data was instructional delivery.

Table 4.12
Interview Coding Frequencies

Codes	Occurrences
Motivation	72
Reason to Use	29
Reason to Not Use	19
Other Barriers	26
Delivery	67
Peer Support	53
Institutional Resources	35
Student Use	25
Institutional Support	21
Student Learning	13
Design	12

Methods, strategies, and specific types of technological tools comprised these statements made by the faculty members. Each code will be discussed in the separate sections that follow.

Motivation

The repetitive occurrences concerning motivation throughout the interview data were viewed as those consisting of an internal nature and those of an external nature. General motivation for change comprised the largest category while breaking out the motivational reasons for using technology or not created a total of three major groups of comments. The overriding theme within motivation for change was the need for an internal perception of relevance. “I think that the missing link for faculty again is helping them to understand how it’s beneficial to them” and “The piece that is always forgotten when we move forward is the needs assessment” are statements demonstrating this. One interviewee stated it this way: “I have to develop a requirement in my mind. So, if I think

that my class teaching style needs technology, my classroom needs technology... that's my requirement."

Many comments referred to a desire to use technology. Often these statements were directed toward particular types of technology, such as interactive student response systems, online surveys, or new ways of gathering data. One faculty member indicated that there is a "certain fascination or attraction to it." Aptly stated by another faculty member is, "one of the driving motivations for me to adopt new technology is that I see it being done and I know that it's possible and I want to emulate it."

Perceived benefits from using technology were stated in a variety of ways. Most saw technology use as a means for efficiency, organization, and speed. "It's got to be useful" and "Until you find out how useful some things are, some people just don't like doing things in a new way" are comments illustrating the need to see usefulness in using technology in order to bring about a change.

Although one respondent indicated that he learned new programs "by crisis", most commented that they began using technology due to some type of positive benefit. "Seeing that it enhances student learning", "The ability to present more complex information", and "to reproduce something of higher quality than drawing on the chalkboard" are quotations representing perceptions of the positive benefits of using technology. The following succinct quotation summarizes reasons to seek out and use new technology. "I think that the likelihood is quite high as long as I perceive that it is valued, number one; that it's helpful, number two; and that I have the resources to help me through the learning process. I think those three components are what make things happen."

Reasons for non-usage were prevalent throughout the interviews, as well. The interviewees commonly focused upon the reasons of non-support, difficulty, and impracticality. One mathematics faculty member “discovered that it (software) was far too complicated to ask my students to use without specific instructions. And my courses were such that I didn’t have time to give specific instructions.” Two other interviewees stated that the use of overheads and PowerPoint presentations caused the pace of the class to accelerate and student attention to focus on note-taking rather than absorption and understanding of information. Additional reasons of non-usage followed themes similar to these quotations, “if I don’t see a real solid reason”, “if I don’t see where it is really helping the students”, and “I don’t want to feel like I am dependent on it.”

One overwhelming barrier mentioned was the lack of time for instructional design. This is predominant in current research literature, as well, and is a common complaint heard by professional developers from teachers and faculty members. Time, as a barrier, appeared consistently in terms of preparation. “It is extremely time-consuming” and “Putting those test banks together is exhausting in time and effort” were two such comments. Another interviewee stated it this way: “Putting together a PowerPoint presentation is technically not that difficult, but it’s time consuming as all get-out. My personal opinion is that PowerPoint is heavily overused at the present time.”

Additional statements related to time involved “It’s just a matter of finding the time to learn it” and “... spending a lot of time on something that will have minimal impact on student learning.” One faculty member summed up the time element in using technology as, “Even though I think it’s really important, I’m just not willing to invest the time it takes.”

The predominant statement within general barriers concerned technology that did not function properly. There seemed to be no blame placed, but the concerns for this were overwhelming. “I get very frustrated when things don’t work the way they are supposed to work.” “That’s one of the problems about technology is that you run into technological problems.” “In fact, if the computer projector is not working, then it’s a disaster. I can’t really have a review session cause I don’t really make overheads up of my answer keys anymore.” This comment leads into one concerning over reliance upon technology. “The downside of course is that people get highly reliant on this stuff after awhile. It’s not unusual for the classrooms I’ve taught in where you walk in one day and the computer doesn’t work. Then what do you do?” A culminating comment addressing this issue was stated by one faculty member as, “These are the things that everybody has to deal with. I just think it makes for a challenge to try to implement it in the classroom. You never quite know if it’s something you are doing or if it’s something with the technology.” Still other barriers were expressed about the lack of evidence that technology enhances student learning and that there is a “steep learning curve” associated with the use of technology in the classroom.

Institutional Resources

This reporting category reflects analysis coding focusing upon institutional resources provided by the university. There was a general mixture of comments concerning institutional resources, both positive and negative regarding the need for resources to make technology happen in the classroom. “it is the university’s responsibility to provide state-of-the-art facilities” and “More and more of the classrooms have computer projectors and computer systems in them. Which I think is very nice” are

two comments representing the presence of computing at the university. Several comments made note of particular technology that the university provides or should provide, such as, “We haven’t made a lot of use of the wireless capabilities. We do have a wireless network here in Lockett” and “We’d probably like to see a policy where every student had to have a laptop.” A related comment from a faculty member who is not located in a “hot spot” for wireless activity on campus is, “We are not wireless. We don’t have PDAs and laptops for our students like some universities... like some high schools.” One interviewee commented,

I think that once we change our philosophy and say that computers are actually consumables and that they are constantly in need of replacement about the time you set them on the desk that what you have is just a constant evolution of replacing old equipment. We have lots of great up to date classroom stuff, but the people who are generating the knowledge, the people who are the subject of your study are typically suffering with old stuff.

Institutional Support

Regarding institutional provided support and recognition by the institution for using technology, there were comments centering on technical support and also on the professional development opportunities on campus. “Sometimes you can get a lot of help and sometimes there’s no help available” and “You can call the Help Desk all you want, but it doesn’t mean that they will get it fixed” represent statements on available technical assistance on campus. In regard to general support, one faculty member stated, “If I have a person or some means of accelerating that learning curve, then that’s what really drives me to use the technology.”

Most interviewees had taken an institution-provided workshop or training session. The predominant topic was either Blackboard or Semester Book course management tool

training sessions. The concurring statements were that they attended as a requirement for access to these tools. One faculty member said, “We go to the workshops both for testing, technology insertion, and the ways we should be teaching the classes. So we go to all kinds of workshops and technology just happens to be one of them.” Another added, “Very few of our faculty in this department take advantage of those things and I have a feeling if you asked them why would be time.” Also included was,

People see things like teaching seminars and education related things as, I don’t want to say superfluous necessarily, but lower priority shall we say, than getting their grants or getting their pubs out, because those are the things that will make them or break them.

Also evident in the data was the dependence on outside sources for technology training and information other than that provided by the university. References were made to National Science Foundation sponsored workshops, book publishers providing training on the electronic resources provided with textbooks, and software developers and equipment manufacturers providing training on specific software packages and specialized electronic equipment.

When asked to respond to whether technology should play a role in faculty recognition or tenure and promotion, the faculty members were in agreement that it should. There were doubts that it ever really would, however. Representative comments include, “I think that it’s important, but I don’t think anybody at a significant level at the university is ever going to think of including that as something of worth” and also

Why should I embrace technology when the only thing that I ever get asked is, “well, how many publications do you have”... “well it’s nice that you did that, now how many publications do you have.” I think that there is a disconnect between what we say and what we do... It’s the whole idea that you ask me to do things, but then you hold me accountable for other things that I do get rewarded for. Well, I’m not stupid. Do I want to

spend my time learning how to do PowerPoint or do I want to write another article. I think that that's an issue for Research I institutions in particular.

A supporting comment to this was, "The expectation is that you will have nationally funded research programs, not an education program. So in the recognition sphere, it can be more of a negative than a positive." Additionally, this comment was noted, "Innovative teaching has usually not carried a lot of weight."

Peer Support

An important construct in this study is the importance of peer support in helping university faculty members adopt and implement technology innovations. There was overwhelming positive support for this idea within the statements made by the interviewees. The comments were categorized into 'how it happens', 'methods to support it', and 'collegial atmosphere'.

Faculty members had similar comments concerning the 'how' that peer support takes place.

I am very sensitive to when people are using technology and how they are using it. And so if I see something that is being done, I'm right there ready to figure out how to use it... I see the ways that people are doing things and I want to emulate that.

"Hearing people talk about it" and "I just like having people help me do it" were two additional statements in this category. One faculty member stated, "I think the biggest factor is the personal touch... I think just the access of someone to get you excited about it... I think it is good to be exposed to what other people are doing." The need for interaction was made evident in this comment, "I could stay on my own little island, but if I continue to do that, then I probably wouldn't seek out much." Communication was brought out in this comment, "There's simple things like just being able to send a file to

somebody anywhere in the world...I collaborated with a guy down in Rio de Janeiro and we would send files back and forth. So, that was great.”

When asked how they felt that collegiality among faculty members could be augmented, the interviewees were in agreement that talking and sharing was essential. Providing a means to make that happen was addressed.

I think it would be wonderful if we had some way of having a technology brown bag where someone might demonstrate a project that they have their students do that utilizes technology, or some way or trick of the trade that they've learned to integrate technology into their courses. I think that would be great. It would expand my bag of tricks that I can use with students. Informally, I think people just... that we have to talk about it.

Other comments include, “informal small group things with a focus”, “What I generally do is figure out people who know more than I do”, and “last year when we were just getting the information, it was just all the people that were interested in being on the project of doing things in the big classes using technology.”

Two similar quotations indicating a means of supporting collegial activity follow.

I do talk to a lot of colleagues about things. We have a lunch group in here every day with faculty colleagues having lunch. We do talk about teaching methods and stuff. We talk about the interactive student ‘clickers’. And almost all of us think it’s a great idea and...of the ones we hang out with... the ones that are concerned with teaching I think are willing to give it a try.

We have had a tradition for years where at the end of the work day, at the end of the week, we might go over to what we call the club for a couple of hours and we sit and we talk. We talk about what happened that week, we talk about something that happened in our unit, we talk about have you ever experienced anything like it... what did you do... We do a lot of informal sharing of experiences and basically a lot of the things I learned by going to those types of meetings. I think that if we had some type of... I mean, we have the Faculty Club... you know. If there was some type of atmosphere developed where we'd all go over there on a Friday

afternoon at 3:00 and sit around and discuss things, then we would have a lot more sharing of ideas, than if we had a structured, every Tuesday at 9:00 we have a committee meeting.

The previous quotation leads into the next category of Peer Support interview data, which is ‘collegial atmosphere’. In recognition of peer support’s role in his development of technology, one faculty member stated, “Certainly, I’ve learned a lot from a lot of the other people. I could have gotten to a certain level by myself, but not to where I got to with the help of other people.” Another comments that, “The people that I am more likely to go to are the people who like myself have some knowledge but not a lot. We may not know the fancy terminology but we can fight our way through it.”

Two faculty members spoke of the need for “a person (who) is willing to help and not feel like they are being imposed on” and “I can tell you you’ve got to have a spirit of non-judgmental behavior...I think we cross a boundary that we might be viewed as stupid or less of a great person or whatever... less of a Ph.D. that we can’t do it... I think that people don’t ask enough and that’s just silly.”

Design

The construct of Design was addressed with several comments on the need to do things more efficiently. Several faculty members noted their involvement in the development of online “textbook-type materials”, “online tests and homework”, “online lecture notes”, and presentations for their classes. The majority of interviewees mentioned the use of Semester Book or Blackboard for course management. One faculty member stated, “I went to the trouble of setting up a course on Blackboard and realized that this is not what I wanted to do. Blackboard does more (than Semester Book), but I don’t need more.” A current university initiative toward expanded research and national prominence

was noted as the factor that, “forced us to think about how to do some of the entry level math courses in very large classes. We would take a whole new look at it and we would utilize the most modern kind of technology that we could.”

Delivery and Usage

There were many varied comments concerning delivery, either concerning methods, requirements for delivery, how technology assists in delivery, or how classroom delivery is changing due to technology. What follows is a diverse picture of mainstream faculty members’ perceptions and usages of technology in the delivery of instruction.

The data presents evidence of a narrow definition for technology integration. Multiple references to PowerPoint as a singular method of technology integration were present in five of the nine interviews.

Blackboard and Semester Book were discussed as a mode of delivery in the sense of the types of information that were posted for student use. They were deemed as a “source of communication I want my students to know.” One interviewee stated it this way: “What I say in the classroom is not the same thing that I have online. They’re related, but my mode of presentation is different. I try consciously to get that presentation to two different levels.” A variety of software packages were mentioned as a means to help students with homework problems and to help in visualizing complex information. Regarding the use of technology in course delivery, one faculty member stated that, “if you are in teacher education and you are to be training teachers to do this same kind of thing because it is effective instructionally, then it just should be written into a job description.”

Two related quotations of length are included in this analysis due to their relevance to the purpose of using technology in teaching through effective delivery methods. The

two faculty members are from different academic colleges and teach very diverse subject matter, but common themes emerged between the two.

The gems that you think are really important, that the next generation of students is going to need to be prepared to deal with, those are the kinds of things where I am more likely to use technology because they are new or because they are more complex or they are more visual...Where the visual impact together with the explanation is more powerful than either alone. And that is what my criteria is for whether or not I implement something or not. Are they going to get more bang for the buck out of it? If not, I'm not going to do it.

The second quotation follows a similar theme:

Well, it helps get across visually a lot of things that are very difficult to describe using words. So you can use a lot of simulations... a lot of online video now. You can use a lot of audio. There's a lot of neat things that you can bring into a course or a lecture that broadens the delivery method to your students so that they are not just listening to a lecture. They are visually seeing things... they are hearing things. So it really opens up a lot of avenues to let the students' brains synthesize the information that you are trying to give them. It gives them a different methodology to get that information in their heads.

In looking to the future of the delivery of courses using technology, one faculty member noted, "We see the large classes as temporary. We see them in an evolutionary stage leading to less lecture -- online lectures actually -- and more lab-based classes."

Another theme that emerged concerned teaching in general. The faculty members made note of "old-fashioned" ways of teaching as opposed to teaching with technology. The differentiation was evident in several comments, such as, "I've seen people just read their slides and that's not accomplishing anything. You might as well take the book and underline the parts you want them to read. That's not teaching." Another comment

representative of teaching without technology as a preferred means is, “I want them to communicate with me with pencil and paper so that they can put their ideas clearly on a piece of paper so I can interpret them and we have this communication going...” A culminating quotation on this emergent theme follows:

Oh, I’m always very interested in technology. But I am also a dinosaur in a lot of old ways....handwritten homework assignments, handwritten quizzes in class. Writing across the curriculum, I think, is very important in the university agenda... I really think some of the old traditional methods of teaching are still the most effective.

Student Use

The data reveals that faculty members are very cognizant of the connection between technology use by students and their learning. They seek a positive reinforcement of that belief. “It’s got to make my life easier and it’s got to make the students’ lives easier. I have to know that the outcome is worth the effort.” Additionally, one commented that a significant factor that augments their desire to use technology is, “to be more effective at getting the students to learn the material.”

The majority noted several means of students’ using technology in their courses. These included “having well-organized notes and having the students to have some sort of access to the notes, preferably ahead of time...” Also the access to study guides, review materials, and the instantaneous feedback on grades were noted as positive uses of technology by students. One faculty member noted the spread of the use of the interactive student response systems across campus and is “very eager to actually try this type of technology.” Another use of technology by students is that of video production. “I have tried to incorporate student video and digital editing of the video. The learning curve is enormous, but I think at the end they were pleased that they had that skill.”

Several faculty members indicated a use of online homework and online quizzes. One expressed negative feelings in that usage as, “I’m not eager to adopt that type of technology. I use old-fashioned hand-graded homework assignments which allow you to do essay questions which I think is higher order.” Another stated, “I don’t follow up on whether students are using technology.” As additional evidence of limited required student use, this faculty member stated, “The only reason I allow them to use calculators even is that sometimes there are messy little computations they feel more comfortable doing on the calculator.”

On a positive note of student use, a faculty member in the sciences stated, “One of the places where I think IT is really important is in the lab... students can actually see what they are supposed to be doing... I think that is very powerful.” Also the use of database searches and analyzing data were offered as reasons for students using technology in classes.

It was noted that “to use it (software) with students, it has to be fairly user friendly” and that there should be equitable access to all technology by all students. This comment was, “In my opinion, there are no different sets of groups on this campus. If something is good enough for one set of students, it ought to be good enough for all sets of students.”

Student Learning

As evidence of corroborative information concerning the fact that faculty members desire information concerning the benefits to student learning that technology can make, a faculty member was hesitant to attribute technology use to changed student learning. He stated it as, “I think that it enhances their learning. Has it changed their learning somewhat or made it better? I don’t know because I don’t have a baseline for that.”

There were negative statements in regard to the connection of technology to learning, as well. “Mostly what I want to be able to do is measure their intellectual growth in those areas (previously mentioned mathematical skill areas). And to that extent, I would just as soon leave the technology out of it.” Another instance was, “I want to see something that shows that technology is making it better for the student to learn better. I’ve seen plenty of people use technology and it has actually degraded student learning.”

Some faculty members were more positive, such as, “I try to implement that kind of technology so that students feel empowered by learning. To see that it is not that big of a deal... that they can do it and they enjoy using it.” When asked whether technology use was causing positive change in his classroom, one faculty member put it this way:

I’m going to say no, but I going to also say yes. Because I don’t think it has made a big difference in the classroom. I think they like having their handouts all printed up in their notebooks and the neat little lines on the side so they can take notes and they like seeing everything on the screen. But that’s no different than what we used to do before. But where I have seen a huge positive impact is in my online class in the discussion board. That may have been an artifact of this particular group. But I had some very strict guidelines for how they had to participate and how they were going to be evaluated for their contributions. I was absolutely stunned with the quality, the depth, and the richness of their interactions compared to what they are capable or are willing to do in the classroom. So in that regard I think that the online classes perhaps aren’t as good a didactic learning experience, but certainly it promoted thinking in a way that the classroom experience did not.

While there were relatively few comments directly related to student learning, it was evident that faculty members view student learning as the final outcome of using technology in teaching and learning.

Interview Summary

Several themes emerged from the interview data.

- There was overwhelming support and agreement in the need for a means for faculty to share their successes and failures in using technology in the classroom
- Peer support is a prevalent means of learning new technologies in a familiar, relevant environment
- Faculty members expect the institution to provide adequate resources and technical assistance
- Mainstream faculty are interested in technology innovations
- Mainstream faculty members utilize technology frequently in ways that are meaningful to their chosen pedagogical methods and course requirements.
- They are interested in ease of use and effective delivery methods
- There is interest in enhancements to student learning
- The faculty members interviewed see importance in recognition for excellent teaching efforts

There was an overall relation in the interview findings to study constructs and the interviews provided corroborative data to the previously analyzed statistical data. Faculty members are motivated for a variety of reasons and have strong opinions on the ‘why’ and the ‘why not’ of technology use in teaching and learning.

Summary

This mixed methodology study was designed to provide data regarding the process by which mainstream university faculty members adopt and implement technology in teaching and learning. A survey provided descriptive data on the study sample and

resulting means and standard deviations on construct indicators. These data allowed analysis of levels of agreement within the indicators.

Correlations between the survey variables were used in the testing of the conceptual technology integration process model. Path analysis resulted in path coefficients indicating relationships between variables and significant direct effects to variables.

Interviews were conducted and the constant comparative method of analysis was employed. Patterns of perceptions and usage among participants emerged lending data that triangulates with survey and path analysis data.

CHAPTER FIVE

DISCUSSION AND CONCLUSIONS

The primary purpose of this study was to determine significant factors affecting the technology integration process engaged in by mainstream university faculty members, thus implying the development of a technology integration process model that could guide professional development. This study has joined a currently evolving line of inquiry focused upon the effects of adopting and implementing technological innovations to enhance teaching, learning, and pedagogical productivity at the post-secondary level.

Research within this study employed both qualitative and quantitative methods to derive a variety of data capable of being triangulated. Results from this effort have allowed the researcher to draw conclusions based upon the findings and provide future researchers with suggestions for further research on this topic.

This chapter will address: (1) a discussion of findings, (2) conclusions, and (3) implications for future research.

Discussion

Within each phase of this study, pertinent data was gathered to assist in answering proposed research questions. The survey provided quantitative data that illuminated descriptive characteristics of the mainstream faculty group as a whole. The data suggests that mainstream faculty members are involved with technology at varying levels meeting various relevant needs. The factors that appear important in motivating their technology integration process are institutional support and peer support.

Survey data implies that the mainstream faculty members utilize peer support when possible and that they learn about technology from others. The approach of this research

afforded a means to explore the stories through interviews (Wenger, McDermott, & Snyder, 2002) and derive meaning from the data relating to the influence of peer support in augmenting innovation adoption by mainstream faculty members. The inclusion of peer support in professional development designs seems to play an influential role in faculty member adoption and implementation patterns and strategies. Knowledge concerning the role of collegial activities informs strategies for the cultivation and development of communities of practice.

It seems that although there is not widespread availability of informal communities of practice in which faculty members can participate, they value dialogue with their peers. Relevance to their discipline appears to be an important element in their learning about technology integration in teaching and learning. While institutional resources, institutional support, and peer support seem to impact a faculty member's motivation to use technology in instructional design and delivery, the data suggests that they perceive benefits to student learning as an essential reason for integrating technology.

Testing the conceptual technology integration process model provided statistical results that appeared to indicate that proposed paths of impact between the study variables were descriptive of a viable technology integration process. The data indicated that the variables Institutional Support and Peer Support affected Motivation, which in turn impacted Instructional Design, Student Use, Learning Process, and perceived Student Learning. There appeared to be significant linear linkages between Instructional Design, Instructional Delivery, Student Use, Learning Process, and perceived Student Learning, as well. The model showed goodness-of-fit to the tested data and appeared to be a reasonable explanation of the trends in the data.

Triangulating data from a variety of sources provided corroboration concerning the implications of the results. Trends in the interview data seemed to support the finding that faculty members find learning from peers beneficial. Emergent patterns surfaced that implied a disconnect in faculty members' beliefs on best teaching practices and the inclusion of technology. It appeared that faculty members do not view the two as seamlessly integrated. The value of qualitative insight provided by the interviews allowed the researcher to augment the quantitative findings revealed in the previous phases of the study.

This study approached the development of a technology integration model from a process approach and included the component of peer support as an essential step in the process. What appeared to have emerged are the practical implications for professional developers of faculty development. The research implies the need for professional development for university level faculty that focuses upon discipline-relevant learning opportunities. A mode of delivery could emphasize peer support and opportunities for collegiality. The data appears to support the idea that faculty members value the acquisition of knowledge of technology integration and its benefits for themselves and for their students prior to attempting any type of implementation.

The implications of the various analyses are related due to the common constructs represented in each of the research phases. The data seems to imply connectivity between these constructs and between the findings of the various analyses.

Conclusions

Based upon the findings within this study, this section contains conclusions that are discussed and organized by Research Question. Findings from survey data, path analyses, and interview data are included.

Research Question 1: What factors enable a mainstream faculty member to adopt technology innovations into their personal teaching and learning?

All of the study factors appeared to have a direct or indirect effect on some phase of a faculty member's process of technology integration. Peer Support, Motivation, and Instructional Design emerged from the data as having the largest significant total causal effects on the tested variables in the technology integration process model. Institutional Support, Institutional Resources, Instructional Delivery, Student Use, and Learning Process all exhibited significant direct effects on the tested variables. The tested path relationships appear to satisfy the proposed linkages in the study. Interview data corroborated these linkages and the prevalence of some over others.

Research Question 2: What role does institutional support play in adoption and implementation of educational technology innovations?

Faculty members utilize institution-provided technical support via help desks and technicians. They participate on a low scale to institution-provided professional development. Through the interview data, it appeared that faculty members expect these to be available and make use of them when relevant to their particular case. The tested model presented findings that Institutional Support had significant total causal effects on three endogenous variables, particularly on Motivation. While agreement levels within the survey indicators were generally just above neutral, the data implies that the study findings

from the survey, the tested technology integration model, and the interviews may inform the development and implementation of more effective, discipline-specific professional development offerings at the tertiary level.

Research Question 3: What role do institutional resources play in adoption and implementation of educational technology innovations?

Faculty members depend upon the availability of institution-provided resources and seem to expect their presence. They indicated in several instances in the interview data that it is the university's responsibility to provide the resources for faculty and student use of technology. The tested model presented findings that Institutional Resources had a significant total causal effect on one endogenous variable, Instructional Delivery. Although availability to institutional-provided resources appeared necessary to the faculty members, it was not a significant factor in their motivation to adopt and implement technology.

Research Question 4: What role does informal membership in communities of practice play in adoption and implementation of educational technology innovations?

The survey results together with the tested path model and the qualitative interview data appeared to indicate that faculty members prefer peer support along with expected institutional support and resources. Peer Support had a significant direct causal effect on Motivation, measured as the motivation to integrate technology into teaching and learning. Peer Support also had significant indirect effects on Instructional Design and Instructional Delivery of technology. It had significant total causal effects on six tested model variables. Recognizing, nurturing, and cultivating communities of practice at the university level presents a challenge for professional developers working within the unique university culture and with a broad, diverse pool of participants. Administrative support from the

departmental level is a necessary component of providing the atmosphere, time, and leadership for the development of these informal communities. These communities of practice can be enabling venues for faculty in their self-paced development. The collegiality and support for experimentation can provide faculty members with assistance in their risk-taking ventures.

Although current professional development models and strategies are emphasizing the need for collaborative work among participants, the university climate and culture is slow to change to accommodate this aspect. Professional developers and university leadership must work in tandem to create opportunities that allow for the development of communities of practice. Brown-Bag seminars, informal departmental meetings, encouragement of new faculty inclusion, recognition of emergent leaders and new adopters, encouragement of the growth of personal networks among interdepartmental and cross-departmental colleagues, recognition of divergent thinking and innovative applications of technology, and recognizing all levels of participation are all target goals and strategies designed to nurture and cultivate communities of practice (Wenger, McDermott, Snyder, 2002).

Designing professional development using the Technology Integration Process Model will possibly assist in placing a focused emphasis on communities of practice and the roles of information sources or channels in helping mainstream faculty members in their process of technology innovation adoption. This conducive atmosphere in which mainstream faculty members may begin their journey toward the adoption of effective technology integration will assist in ensuring appropriate modeling for pre-service teachers

by all those influential instructors, teachers, and professors that provide them with their referential framework for high-quality teaching in the 21st century.

Research Question 5: What role does technology in instructional design and delivery play on the learning process and student learning outcomes?

The data seemed to illustrate that faculty members choose technology integration because they perceived a benefit either for themselves as educators or for their students' increased learning potential. The faculty members' generally agreed that a perceived increase in student learning was a motivating factor for them to spend time in the design of their courses to incorporate technology and in requiring students to make use of technology in assignments. Both Instructional Design and Instructional Delivery had significant direct total causal effects. Instructional Design on Instructional Delivery and Instructional Delivery on Student Use of technology emerged as significant factors in the tested technology integration process. Instructional Design has significant total causal effects on a total of four tested model variables. The faculty members indicated through survey data that the student-student interactions, the teacher-student interactions, and the student-content interactions were enhanced through the use of technology.

This study gathered data concerning the 'how, when, why, and why not' of mainstream faculty members' process of technology integration into teaching and learning. The 'why not' aspect of the study seemed to be revealed when faculty were unable to discern a relevance to their discipline, a self-benefit, or a perceived impact to student learning. According to this study, the faculty members appear to value effective teaching. The ability to determine a direct connection between effective teaching and the use of technology is a critical component in assisting them along the journey of integration.

The most significant conclusions of this study are the emphases on the importance of peer interactions on faculty learning about technology within their progression through the technology integration process and the emergent theme of faculty perceived importance of a strong link between relevant use of technology, effective teaching, and the perceived benefit to student learning.

Recommendations for Institutions

Based on the results of this study, the following are a summary of institutional practices that the faculty perceived to be effective in supporting their use of technology in their teaching.

Community of Practice

The data indicate that faculty members prefer peer support as a means of developing their knowledge base and as a means to share best practices. The following are practices suggested by the faculty that utilize the community of practice model.

1. Brown-Bag seminars focused upon sharing technology tips and practices proven to be effective within classes.
2. Informal departmental meetings at specified times for sharing of information.
3. Informal lunch meetings as a come and go event for discussions on teaching practices.
4. Departmental support in the recognition of faculty who are willing to share information and knowledge concerning teaching with technology.

Institutional Support

Study data supports that faculty utilize institutional-provided support and that it is important in contributing to faculty motivation to use technology in teaching and learning.

The following recommendations emerged from the study data:

1. Readily available institutional support via help desks and technicians
2. Institutional-provided opportunities for professional development offered in a discipline-specific format.
3. Institutional-provided opportunities for professional development focusing upon the seamless integration of best teaching practices, the use of technology, and the possible benefits to student learning.

Institutional Resources

As the data indicated that institutional resources were not a significant factor in faculty members' motivation to adopt and implement technology, there were data that emerged from the study in the form of suggestions. These are delineated as follows:

1. Faculty members expect the university to provide appropriate hardware and software necessary for the integration of technology in teaching.
2. Necessary hardware and software should be upgraded on a consistent, cyclical basis to ensure up-to-date access for faculty in designing and delivering instruction.

Implications for Future Research

As this study moved beyond research on technology skills or self-efficacy, so should future research on the topic of technology integration branch out into additional venues. This study contributed to the line of inquiry and provided data interpretation of

faculty use of technology at the university level and its role in empowering instructional change. The conclusions revealed new areas of study revolving around two key themes.

The implications for future research on theory development involve the possibility of further development of the technology integration process model. Model constructs could be refined with the division of Motivation or Learning Process. Researching the components that occur within the learning process and the shifts in philosophy, pedagogy, and student expectations necessary for change would serve to broaden the findings of this study. Further research into the impact of technology on teacher-to-student, student-to-student, and student-to-content processes would add new dimensions to the understanding of teaching and technology at the collegiate level.

An additional theme for future research possibilities is evident in the implications for practice. Much research knowledge could be gained by studying the impact of communities of practice among university faculty and the development, nurturing, culture, and institutional expectations involved in their effective existence. There is also a relevant need for additional research concerning professional development at the university level and how communities of practice could be incorporated within the professional development offerings. This is particularly relevant to Research I institutions with similar goals and emphases that often do not focus on teaching or technology integration strategies.

Implications for future research also lie within the realm of studying the expectations of collegiate students concerning technology usage in the classroom environment and for assignments. Noteworthy would be an emphasis on how faculty use or requirements for technology affect the way college students feel that they learn best.

There are recognized limitations within this study involving several components that could be addressed in future research. The sample size, which although met size requirements for the type of analyses conducted, was generally small causing limited generalizability to the population. Sample selection was limited to three academic colleges and could also limit generalizability to the campus faculty as a whole. The survey was researcher-created and would require additional dissemination to other samples to acquire additional reliability. It is noted that self-selection of stages of adoption is subjective and that there is an overlap of stages with faculty members having different entry points and different amounts of time spent within each stage. In regard to causal modeling, it is indicated that the final model is tentative until replicated with additional data sets. A recursive structural model is an approximation due to true relations between variables being generally nonlinear.

Resulting insights from this and future research may aid those faculty members traveling through stages of technology integration into teaching and learning and those who have not yet begun the journey.

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APPENDIX A

FACULTY SURVEY INSTRUMENT

FACULTY SURVEY INSTRUMENT

The Process of Technology Adoption and Integration into Teaching and Learning by University Faculty

Instructions:

The following statements have been formulated to assist in the development of a model(s) of processes that higher education faculty follow in the adoption and integration of technology into teaching and learning. **Technology integration into teaching includes your technology use in teaching preparation, your technology use in instructional delivery, and technology usage that you require from your students both in class and outside of the classroom.**

This 108-item survey should take approximately 25 minutes to complete. Your responses are extremely valuable contributions to this dissertation study and your effort and time spent are sincerely appreciated.

Please check (√) or write the response that most clearly represents your opinion, attitude, situation, experience, or knowledge.

Please indicate your level of agreement with each of the following statements using the following scale:

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

1.	General Perspectives	1	2	3	4	5
a.	My knowledge and strategies of technology integration in teaching are primarily the result of institution-provided professional development.					
b.	My knowledge and strategies of technology integration in teaching are primarily the result of informal collegial instruction or support.					
c.	My knowledge and strategies of technology integration in teaching are primarily self-taught.					
d.	Teaching is an important aspect of my professional career.					
e.	Technology integration into teaching and learning is very important for my students.					
f.	Effective technology integration can be a positive change agent in student learning within my discipline.					
g.	I value dialogue with colleagues concerning effective technology-integrated teaching practices.					

1= Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree, 5= Strongly Agree						
		1	2	3	4	5
h.	My teaching philosophy reflects my beliefs that students learn most effectively through teacher-student interaction.					
i.	My teaching philosophy reflects my beliefs that students learn most effectively through student-student interaction.					
j.	My teaching philosophy reflects my beliefs that students learn most effectively when provided opportunities to interact with content and construct their own learning.					
2. Barriers to Technology Integration						
a.	I do not have enough personal technology skills to integrate technology into teaching and learning.					
b.	I cannot depend upon readily-available tech support.					
c.	While designing my course(s), I feel that the inclusion of technology requires too much of my time.					
d.	Technology integration into teaching and learning requires too much of my class preparation time.					
e.	Technology integration requires too much time within my course delivery.					
f.	Using technological means (e.g. email, Blackboard email, etc.) to communicate with my students requires too much of my time.					
g.	Technology integration efforts are not important for my tenure and promotion process.					
h.	I cannot depend on access to essential hardware.					
i.	I cannot depend on access to essential software.					
j.	There are limited institutional professional development opportunities at my university.					
k.	My university does not provide enough professional development opportunities that target the use of technology in instruction.					
l.	There is little or no administrative support for the integration of technology into teaching and learning.					
m.	There is little collegial sharing, discussion, or support in my department.					
n.	The course I teach does not lend itself to technology integration.					
o.	I lack essential knowledge of how to effectively integrate technology into instruction to benefit student learning.					
p.	I have no concerns about using technology in teaching.					
3. Motivation for Technology Integration						
a.	Technology integration benefits my students.					
b.	I am personally gratified from learning new technology skills and strategies.					
c.	I see technology in teaching as a welcome challenge.					

1= Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree, 5= Strongly Agree						
		1	2	3	4	5
d.	Technology integration in teaching results in recognition among my peers.					
e.	I follow technology integration advice from a colleague.					
f.	I observed successful use of technology integration in someone else's class.					
g.	I received student requests to incorporate technology into my teaching.					
h.	I received administrative requests to incorporate technology into my teaching.					
i.	I am following an inevitable educational trend.					
j.	I participated in shared-decision making concerning departmental technology adoption.					
4.	Goals for Technology Integration					
a.	Through the use of technological tools, I am able to present more complex work to my students.					
b.	Through the use of technological tools, I expect an increased level of collaboration among my students.					
c.	Through the use of technological tools, I am better able to tailor students' work to their individual needs.					
d.	Through the use of technological tools, I will spend less time lecturing to the entire class.					
e.	Through the use of technological tools, I will spend more time working with smaller groups who are pursuing project-based work.					
f.	Through the use of technological tools, I will spend more time preparing materials and resources for instruction.					
g.	Through the use of technological tools, my students will more fully master my course content.					
h.	Through the use of technological tools, my students will increase collaborative/communication skills.					
i.	Through the use of technological tools, my students will show improvement in learning tasks, such as writing, analyzing data, or solving problems.					
j.	Through the use of technological tools, my students will demonstrate a higher level of interest in the subject.					
k.	Through the use of technological tools, my interaction with students will increase.					
l.	Through the use of technological tools, my students can work in an environment which appeals to a variety of learning styles.					
m.	Technology integration in my course provides a means of expanding and applying what has been taught.					
n.	I have no goals for integrating technology in my teaching.					

1= Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree, 5= Strongly Agree						
		1	2	3	4	5
5.	Resources					
a.	I have sufficient knowledge of a range of educational technology resources for effective classroom use.					
b.	It is generally easy to obtain the resources I need for technology integration.					
c.	It is easy for me to schedule the use of a technology-equipped classroom.					
d.	My college/department provides access to instructional technology support.					
e.	I would participate more in technical or technology integration training with additional incentives offered.					
f.	I would like to have greater interaction with other technology users to discuss common problems and/or teaching strategies.					
g.	I participate in an informal group or gathering in which discussions of the use of technology in <u>higher education</u> classroom teaching and learning take place.					
h.	My colleagues' opinions about technology integration generally result in my making changes.					
i.	An informal network of friends/colleagues is very important to me as a source of information concerning integrating technology in my teaching.					
j.	Innovative students are very important to me as a source of information concerning integrating technology in my teaching.					
k.	Institution-provided workshops/seminars are very important to me as a source of information concerning integrating technology in my teaching.					
6.	Design					
a.	I am satisfied with my current teaching style.					
b.	I have changed my teaching style due to the use of technology into teaching and learning.					
c.	I consider the use of technology when designing my course(s).					
d.	I use general web-based tools (e.g., web page editor, Blackboard, Semester Book) when preparing my course.					
e.	I use discipline area-specific technology tools when preparing my course.					
f.	I use general multimedia technology tools (e.g., audio, video, image editing) when preparing my course.					
g.	I use content-specific Internet resources (e.g., online tutorials, resource websites) within my discipline area when preparing my course.					
h.	I use online communication with colleagues concerning the use of technology while preparing my course.					

1= Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree, 5= Strongly Agree						
		1	2	3	4	5
7.1	Implementation - Delivery					
a.	I use lecture in my class almost exclusively.					
b.	I use a class/group discussion format regularly as a strategy for my class delivery .					
c.	I use collaborative activities regularly as a strategy for my class delivery .					
d.	I use technology enhanced presentations (e.g., PowerPoint) regularly as a strategy for my class delivery .					
e.	I use features within either Blackboard or Semester Book regularly to present content (e.g., posting lecture notes or resources) to my students.					
f.	I use content-specific technology tools (e.g., probes, graphing calculators) regularly within my presentations during my class delivery .					
g.	I use general multimedia technology tools (e.g., audio, video, image editing) regularly within my presentations during my class delivery .					
h.	I use content-specific Internet resources (e.g., multimedia, databases) within my discipline area regularly within my presentations during my class delivery .					
7.2	Implementation - Student Use of Technology					
a.	I require the use of content-specific technology tools (e.g., probes, graphing calculators) by my students (either in class or for assignments) on a regular basis.					
b.	I require the use of general multimedia technology tools (e.g., audio, video, image editing) by my students (either in class or for assignments) on a regular basis.					
c.	I require the use of content-specific Internet resources (e.g., sites, databases, journals, tutorials) within my discipline area by my students either in class or for assignments on a regular basis.					
d.	I require the use of online communication (e.g., Blackboard discussion, chat, email, interactive whiteboard) by my students to foster group collaboration in learning group discussion on a regular basis.					
e.	Technology use in my classroom encourages more student-centered learning.					
f.	I require student use of technology for authoring class papers.					
g.	I require students to publish, post, or use technological presentation tools in class to present their projects.					

1= Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree, 5= Strongly Agree						
		1	2	3	4	5
8.	Results					
a.	I require the use of technology as an assessment tool in my class (e.g., online tests, CD-based tests, technology-produced paper, product, or presentation/demonstration.)					
b.	I believe that my use of technology in teaching had a positive effect on student learning.					
c.	I believe that my use of technology in teaching had a positive effect on my students' depth of understanding of course content.					
d.	I believe that my use of technology in teaching had a positive effect on the depth and breadth of content covered in my course.					
e.	I believe that my use of technology in teaching had a positive effect on my students' use of higher order thinking.					
f.	I believe that my use of technology in teaching had a positive effect on my students' use of problem-solving strategies.					
g.	I believe that my use of technology in teaching had a positive effect on my students' ability to analyze data.					
h.	I believe that my use of technology in teaching had a positive effect on student participation and feedback.					
i.	I believe that my use of technology in teaching had a positive effect on the interaction between myself and my students.					
j.	I believe that my use of technology in teaching has a positive effect on student interaction with other students.					

Demographic Information

Please check or enter your selected answer to each of the following statements.

9. I first began using technology in my teaching preparation or class presentation:

- _____ 6 months ago
- _____ 1-2 years ago
- _____ 3-4 years ago
- _____ 5+ years ago
- _____ Not applicable

10. I first began requiring technology use by my students for course assignments:

- _____ 6 months ago
- _____ 1-2 years ago
- _____ 3-4 years ago
- _____ 5+ years ago
- _____ Not applicable

11. The stage that best describes where I am within the technology adoption and integration into teaching and learning process is:

_____ **Awareness**

(I am aware of technology and have some basic skills but do not think I have sufficient expertise to use technology without assistance. I rarely require the use of technology by students to complete assignments.)

_____ **Learning the Process**

(I can use basic software and some standard hardware comfortably. My students use basic technology resources to occasionally complete assignments.)

_____ **Understanding and Applying the Process**

(I use a variety of technology resources/tools in my preparation, instructional delivery, and evaluation. My students use a variety of technology resources/tools in the construction of curriculum-based products.)

_____ **Creative Application to New Contexts**

(I am comfortable experimenting with various uses of technology for my teaching. My students are involved in using a variety of technology resources/tools in analyzing and synthesizing information.)

_____ **Facilitating the Process**

(I am eager to share my teaching with technology experiences with my colleagues. I encourage student/faculty interactions in discovering and utilizing different technologies beneficial to learning.)

12. I have attended approximately this number of courses/workshops/seminars on technical help or technology integration in 2004.

- _____ 7+
- _____ 5-6
- _____ 3-4
- _____ 1-2
- _____ 0

13. My level of participation in professional organizations that focus upon teaching and/or technology is best described as:

- ☐ Active Leader
- ☐ Participant/Discussant
- ☐ Peripheral Observer
- ☐ Not a Member

14. I teach in a technology-equipped classroom.

☐ **Yes - by choice** ☐ **No**
☐ **Yes - by assignment**

15. My faculty position is:

- ☐ Professor
- ☐ Associate Professor
- ☐ Assistant Professor
- ☐ Full-time instructor
- ☐ Part-time instructor

16. My gender is:

☐ **Female** ☐ **Male**

17. My age is:

- ☐ <30
- ☐ 30-39
- ☐ 40-49
- ☐ 50-59
- ☐ >59

18. I currently teach in this (these) disciplinary area(s):

19. I have had teaching responsibilities as a member of an academic post-secondary faculty for _____ years.

20. I am currently teaching this number of courses:

1

2

3

4

21. The average number of undergraduate and/or graduate students whom I teach in one semester is _____.

22. My current email address is: (optional for entry into Amazon.com gift certificate drawing OR if you would consider being interviewed within this study)

Thank you for your participation in completing this survey! You have been a valuable contributor to this research study and your efforts are most appreciated. Your email address will be entered into a random drawing for one of five \$25.00 Amazon.com gift certificates. Winners will be notified by email by April 28, 2005.

Contact information: **Pam S. Nicolle**
 Louisiana State University
 nicolle@lsu.edu

APPENDIX B
SURVEY COVER LETTER

SURVEY COVER LETTER

As technology usage spreads across university campuses, research in the development of a model(s) of processes that higher education faculty follow in the adoption and integration of technology into teaching and learning is currently being conducted. As an educational technology consultant, I am interested in contributing to the theoretical knowledge in the educational technology field in general and am hoping to identify ways for better serving faculty in their technology integration efforts at LSU.

Technology integration into teaching includes your technology use in teaching preparation, your technology use in instructional delivery, and technology usage that you require from your students both in class and outside of the classroom.

You have been randomly selected to voluntarily contribute to this research through the completion of an online survey. Your participation as faculty members who serve as critical contributors to the educational development of university students, a broad array of research areas, on-going scholarship, and service is invaluable.

This 108-item survey should take approximately 25 minutes to complete. Your responses will be handled in a confidential manner and released only as summaries with no personal or organizational identifiers.

Clicking on the survey link at the end of this email will bring you to the consent page with an additional link to the body of the survey. The survey is designed to allow for returning to previous screens, if desired. Successful submittal of the survey with your indicated email address provides a communication link to contact you for a possible interview. In addition, it enters you in a drawing for one of five \$25.00 Amazon.com gift certificates.

Thank you very much for your extremely valuable contributions to this research. Your effort, time spent, and prompt response are sincerely appreciated. Please participate in this survey and submit by April 22, 2005.

Pam S. Nicolle
Educational Technology Consultant
LSU College of Education
Ph.D Candidate in Educational Leadership, Research, and Counseling, Specialization in Educational Technology

225-578-1246
nicolle@lsu.edu

APPENDIX C

DOCTORAL RESEARCH STUDY CONSENT FORM

DOCTORAL RESEARCH STUDY CONSENT FORM

Technology Adoption into Teaching and Learning By Mainstream University Faculty: A Mixed Methodology Study Revealing the 'How, When, Why, and Why Not'

Pam S. Nicolle, PI, 115B Peabody Hall, LSU, 578-1246, 8:00-4:30

Survey, observational, and interview data will be collected from randomly selected university faculty members from the Colleges of Education, Arts & Sciences, and Basic Sciences. Surveys will be sent to one-half of those included on current faculty rosters seeking demographic and other information regarding technology integration usage, participation in informal collegial groups, perceived benefits or hindrances of technology implementation in teaching, and teaching behaviors associated with technology integration. Signing this consent form documents my agreement to participate as a survey subject in an investigation conducted by Pam S. Nicolle as part of her dissertation research.

I understand that:

- My participation in this research is voluntary, and may be terminated at any time by my request.
- Participation in this study and/or withdrawal from this project will not adversely affect me in any way.
- Responses will have identifying components. These identifiers will be available only to the researcher and will not be released, shared, or discussed with any other person. This strict confidentiality applies to all phases of this study and to the publishing of the final dissertation report.
- Publication of this research could be disseminated to national, state, or local educational entities or governmental groups. My identity will not be attached to the final data in any way.
- There are no known risks involved in being a part of this project greater than daily ordinary occurrences.

I may direct additional questions to the researcher, Pam S. Nicolle, at the above address or phone number. Email contact is (nicolle@lsu.edu). Her research advisor is Dr. Yiping Lou (ylou@lsu.edu). If I have questions about subjects' rights or other concerns, I can contact Dr. Robert C. Mathews, Chairman, LSU Institutional Review Board, (225)578-8692.

I agree to participate in the study described above and acknowledge the researchers' obligation to provide me a copy of this consent form if signed by me.

Signed _____ Date _____

APPENDIX D

FACULTY SURVEY INSTRUMENT - ONLINE VERSION

CONSENT FORM

Technology Adoption into Teaching and Learning
By Mainstream University Faculty: A Mixed Methodology Study
Revealing the 'How, When, Why, and Why Not'

Pam S. Nicolle, PI, 115B Peabody Hall, LSU, 578-1246, 8:00-4:30

Survey, observational, and interview data will be collected from randomly selected university faculty members from the Colleges of Education, Arts & Sciences, and Basic Sciences. Surveys will be sent to one-half of those included on current faculty rosters seeking demographic and other information regarding technology integration usage, participation in informal collegial groups, perceived benefits or hindrances of technology implementation in teaching, and teaching behaviors associated with technology integration. Signing this consent form documents my agreement to participate as a survey subject in an investigation conducted by Pam S. Nicolle as part of her dissertation research.

I understand that:

- My participation in this research is voluntary, and may be terminated at any time by my request.
- Participation in this study and/or withdrawal from this project will not adversely affect me in any way.
- Responses will have identifying components. These identifiers will be available only to the researcher and will not be released, shared, or discussed with any other person. This strict confidentiality applies to all phases of this study and to the publishing of the final dissertation report.
- Publication of this research could be disseminated to national, state, or local educational entities or governmental groups. My identity will not be attached to the final data in any way.
- There are no known risks involved in being a part of this project greater than daily ordinary occurrences.

I may direct additional questions to the researcher, Pam S. Nicolle, at the above address or phone number. Email contact is (nicolle@lsu.edu). Her research advisor is Dr. Yiping Lou (ylou@lsu.edu). If I have questions about subjects' rights or other concerns, I can contact Dr. Robert C. Mathews, Chairman, LSU Institutional Review Board, (225)578-8692.

I agree to participate in the study described above and acknowledge the researchers' obligation to provide me a copy of this consent form if signed by me.

Signed _____ Date _____

You may print and sign this document and mail to the researcher at the above address indicating consent, or simply click the "Take me to the survey" button below which signifies your consent.

Take me to the survey

Survey

Dissertation Research Survey on The Process of Technology Adoption and Integration into Teaching and Learning by University Faculty

Instructions: The following statements have been formulated to assist in the development of a model(s) of processes that higher education faculty follow in the adoption and integration of technology into teaching and learning. **Technology integration into teaching includes your technology use in teaching preparation, your technology use in instructional delivery, and technology usage that you require from your students both in class and outside of the classroom.**

This 108-item survey should take approximately 25 minutes to complete. Your responses are extremely valuable contributions to this research and your effort and time spent are sincerely appreciated.

Please check or write the response that most clearly represents your opinion, attitude, situation, experience, or knowledge.

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1. General Perspectives

Please indicate your level of agreement with each of the following statements using the following scale: Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree

1 General Perspectives	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
My knowledge and strategies of technology integration in teaching are primarily the result of institution-provided professional development.	☐	☐	☐	☐	☐
My knowledge and strategies of technology integration in teaching are primarily the result of informal collegial instruction or support.	☐	☐	☐	☐	☐
My knowledge and strategies of technology integration in teaching are primarily self-taught.	☐	☐	☐	☐	☐
Teaching is an important aspect of my professional career.	☐	☐	☐	☐	☐
Technology integration into teaching and learning is very important for my students.	☐	☐	☐	☐	☐
Effective technology integration can be a positive change agent in student learning within my discipline.	☐	☐	☐	☐	☐
I value dialogue with colleagues concerning effective technology-integrated teaching practices.	☐	☐	☐	☐	☐
My teaching philosophy reflects my beliefs that students learn most effectively through teacher-student interaction.	☐	☐	☐	☐	☐
My teaching philosophy reflects my beliefs that students learn most effectively through student-student interaction.	☐	☐	☐	☐	☐
My teaching philosophy reflects my beliefs that students learn most effectively when provided opportunities to interact with content and construct their own learning.	☐	☐	☐	☐	☐

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2. Barriers to Technology Integration

1 Barriers to Technology Integration	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I do not have enough personal technology skills to integrate technology into teaching and learning.	☐	☐	☐	☐	☐
I cannot depend upon readily-available tech support.	☐	☐	☐	☐	☐
While designing my course(s), I feel that the inclusion of technology requires too much of my time.	☐	☐	☐	☐	☐
Technology integration into teaching and learning requires too much of my class preparation time.	☐	☐	☐	☐	☐
Technology integration requires too much time within my course delivery.	☐	☐	☐	☐	☐
Using technological means (e.g. email, Blackboard email, etc.) to communicate with my students requires too much of my time.	☐	☐	☐	☐	☐
Technology integration efforts are not important for my tenure and promotion process.	☐	☐	☐	☐	☐
I cannot depend on access to essential hardware.	☐	☐	☐	☐	☐
I cannot depend on access to essential software.	☐	☐	☐	☐	☐
There are limited institutional professional development opportunities at my university.	☐	☐	☐	☐	☐
My university does not provide enough professional development opportunities that target the use of technology in instruction.	☐	☐	☐	☐	☐
There is little or no administrative support for the integration of technology into teaching and learning.	☐	☐	☐	☐	☐
There is little collegial sharing, discussion, or support in my department.	☐	☐	☐	☐	☐
The course I teach does not lend itself to technology integration.	☐	☐	☐	☐	☐

I lack essential knowledge of how to effectively integrate technology into instruction to benefit student learning.

☐☐☐☐☐

I have no concerns about using technology in teaching.

☐☐☐☐☐

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3. Motivation for Technology Integration

1 Motivation for Technology Integration	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Technology integration benefits my students.	☐	☐	☐	☐	☐
I am personally gratified from learning new technology skills and strategies.	☐	☐	☐	☐	☐
I see technology in teaching as a welcome challenge.	☐	☐	☐	☐	☐
Technology integration in teaching results in recognition among my peers.	☐	☐	☐	☐	☐
I follow technology integration advice from a colleague.	☐	☐	☐	☐	☐
I observed successful use of technology integration in someone else's class.	☐	☐	☐	☐	☐
I received student requests to incorporate technology into my teaching.	☐	☐	☐	☐	☐
I received administrative requests to incorporate technology into my teaching.	☐	☐	☐	☐	☐
I am following an inevitable educational trend.	☐	☐	☐	☐	☐
I participated in shared-decision making concerning departmental technology adoption.	☐	☐	☐	☐	☐

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4. Goals for Technology Integration

1 Goals for Technology Integration	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Through the use of technological tools, I am able to present more complex work to my students.	☐	☐	☐	☐	☐
Through the use of technological tools, I expect an increased level of collaboration among my students.	☐	☐	☐	☐	☐
Through the use of technological tools, I am better able to tailor students' work to their individual needs.	☐	☐	☐	☐	☐
Through the use of technological tools, I will spend less time lecturing to the entire class.	☐	☐	☐	☐	☐
Through the use of technological tools, I will spend more time working with smaller groups who are pursuing project-based work.	☐	☐	☐	☐	☐
Through the use of technological tools, I will spend more time preparing materials and resources for instruction.	☐	☐	☐	☐	☐
Through the use of technological tools, my students will more fully master my course content	☐	☐	☐	☐	☐
Through the use of technological tools, my students will increase collaborative/communication skills.	☐	☐	☐	☐	☐
Through the use of technological tools, my students will show improvement in learning tasks, such as writing, analyzing data, or solving problems.	☐	☐	☐	☐	☐
Through the use of technological tools, my students will demonstrate a higher level of interest in the subject.	☐	☐	☐	☐	☐
Through the use of technological tools, my interaction with students will increase.	☐	☐	☐	☐	☐
Through the use of technological tools, my students can work in an environment which appeals to a variety of learning styles.	☐	☐	☐	☐	☐

Technology integration in my course provides a means of expanding and applying what has been taught.

☐☐☒☐☐

I have no goals for integrating technology in my teaching.

☐☐☐☐☐

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5. Resources

1 Resources	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I have sufficient knowledge of a range of educational technology resources for effective classroom use.	☐	☐	☐	☐	☐
It is generally easy to obtain the resources I need for technology integration.	☐	☐	☐	☐	☐
It is easy for me to schedule the use of a technology-equipped classroom.	☐	☐	☐	☐	☐
My college/department provides access to instructional technology support.	☐	☐	☐	☐	☐
I would participate more in technical or technology integration training with additional incentives offered.	☐	☐	☐	☐	☐
I would like to have greater interaction with other technology users to discuss common problems and/or teaching strategies.	☐	☐	☐	☐	☐
I participate frequently in an informal group or gathering in which discussions of the use of technology in higher education classroom teaching and learning take place.	☐	☐	☐	☐	☐
My colleagues' opinions about technology integration generally result in my making changes.	☐	☐	☐	☐	☐
An informal network of friends/colleagues is very important to me as a source of information concerning integrating technology in my teaching.	☐	☐	☐	☐	☐
Innovative students are very important to me as a source of information concerning integrating technology in my teaching.	☐	☐	☐	☐	☐
Institution-provided workshops/seminars are very important to me as a source of information concerning integrating technology in my teaching.	☐	☐	☐	☐	☐

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6. Design

1 Design	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I am satisfied with my current teaching style.	☐	☐	☐	☐	☐
I have changed my teaching style due to the use of technology into teaching and learning.	☐	☐	☐	☐	☐
I consider the use of technology when designing my course(s).	☐	☐	☐	☐	☐
I use general web-based tools (e.g., web page editor, Blackboard, Semester Book) when preparing my course.	☐	☐	☐	☐	☐
I use discipline area-specific technology tools when preparing my course.	☐	☐	☐	☐	☐
I use general multimedia technology tools (e.g., audio, video, image editing) when preparing my course.	☐	☐	☐	☐	☐
I use content-specific Internet resources (e.g., online tutorials, resource websites) within my discipline area when preparing my course.	☐	☐	☐	☐	☐
I use online communication with colleagues concerning the use of technology while preparing my course.	☐	☐	☐	☐	☐

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7. Implementation - Delivery

1 Implementation - Delivery	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I use lecture in my class almost exclusively.	☐	☐	☐	☐	☐
I use a class/group discussion format regularly as a strategy for my class delivery.	☐	☐	☐	☐	☐
I use collaborative activities regularly as a strategy for my class delivery.	☐	☐	☐	☐	☐
I use technology enhanced presentations (e.g., PowerPoint) regularly as a strategy for my class delivery.	☐	☐	☐	☐	☐
I use features within either Blackboard or Semester Book regularly to present content (e.g., posting lecture notes or resources) to my students.	☐	☐	☐	☐	☐
I use content-specific technology tools (e.g., probes, graphing calculators) regularly within my presentations during my class delivery.	☐	☐	☐	☐	☐
I use general multimedia technology tools (e.g., audio, video, image editing) regularly within my presentations during my class delivery.	☐	☐	☐	☐	☐
I use content-specific Internet resources (e.g., multimedia, databases) within my discipline area regularly within my presentations during my class delivery.	☐	☐	☐	☐	☐

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7. Implementation - Student Use of Technology

1 Implementation - Student Use of Technology	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I require the use of content-specific technology tools (e.g., probes, graphing calculators) by my students (either in class or for assignments) on a regular basis.	☐	☐	☐	☐	☐
I require the use of general multimedia technology tools (e.g., audio, video, image editing) by my students (either in class or for assignments) on a regular basis.	☐	☐	☐	☐	☐
I require the use of content-specific Internet resources (e.g., sites, databases, journals, tutorials) within my discipline area by my students either in class or for assignments on a regular basis.	☐	☐	☐	☐	☐
I require the use of online communication (e.g., Blackboard discussion, chat, email, interactive whiteboard) by my students to foster group collaboration in learning group discussion on a regular basis.	☐	☐	☐	☐	☐
Technology use in my classroom encourages more student-centered learning.	☐	☐	☐	☐	☐
I require student use of technology for authoring class papers.	☐	☐	☐	☐	☐
I require students to publish, post, or use technological presentation tools in class to present their projects.	☐	☐	☐	☐	☐

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8. Results

1 Results	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I require the use of technology as an assessment tool in my class (e.g., online tests, CD-based tests, technology-produced paper, product, or presentation/demonstration.)	☐	☐	☐	☐	☐
I believe that my use of technology in teaching had a positive effect on student learning.	☐	☐	☐	☐	☐
I believe that my use of technology in teaching had a positive effect on my students' understanding of course content.	☐	☐	☐	☐	☐
I believe that my use of technology in teaching had a positive effect on the depth and breadth of content covered in my course.	☐	☐	☐	☐	☐
I believe that my use of technology in teaching had a positive effect on my students' use of higher order thinking.	☐	☐	☐	☐	☐
I believe that my use of technology in teaching had a positive effect on my students' use of problem-solving strategies.	☐	☐	☐	☐	☐
I believe that my use of technology in teaching had a positive effect on my students' ability to analyze data.	☐	☐	☐	☐	☐
I believe that my use of technology in teaching had a positive effect on student participation and feedback.	☐	☐	☐	☐	☐
I believe that my use of technology in teaching had a positive effect on the interaction between myself and my students.	☐	☐	☐	☐	☐
I believe that my use of technology in teaching has a positive effect on student interaction with other students.	☐	☐	☐	☐	☐

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Demographic Information

Please check or enter your selected answer to each of the following statements.

- 1 I first began using technology in my teaching preparation or class presentation:
- ☐ 6 months ago
 - ☐ 1-2 years ago
 - ☐ 3-4 years ago
 - ☐ 5+ years ago
 - ☐ Not applicable
- 2 I first began requiring technology use by my students for course assignments:
- ☐ 6 months ago
 - ☐ 1-2 years ago
 - ☐ 3-4 years ago
 - ☐ 5+ years ago
 - ☐ Not applicable
- 3 The stage that best describes where I am within the technology adoption and integration into teaching and learning process is:
- ☐ **Awareness**
(I am aware of technology and have some basic skills but do not think I have sufficient expertise to use technology without assistance. I rarely require the use of technology by students to complete assignments.)
 - ☐ **Learning the Process**
(I can use basic software and some standard hardware comfortably. My students use basic technology resources to occasionally complete assignments.)
 - ☐ **Understanding and Applying the Process**
(I use a variety of technology resources/tools in my preparation, instructional delivery, and evaluation. My students use a variety of technology resources/tools in the construction of curriculum-based products.)
 - ☐ **Creative Application to New Contexts**
(I am comfortable experimenting with various uses of technology for my teaching. My students are involved in using a variety of technology resources/tools in analyzing and synthesizing information.)
 - ☐ **Facilitating the Process**
(I am eager to share my teaching with technology experiences with my colleagues. I encourage student/faculty interactions in discovering and utilizing different technologies beneficial to learning.)
- 4 I have attended approximately this number of courses/workshops/seminars on technical help or technology integration in 2004.
- ☐ 7+
 - ☐ 5-6
 - ☐ 3-4

- 5 My level of participation in professional organizations that focus upon teaching and/or technology is best described as:
- 6 I teach in a technology-equipped classroom.
- 7 My faculty position is:
- 8 My gender is:
- 9 My age is:
- 10 I currently teach in this (these) disciplinary area(s):
- 11 I have had teaching responsibilities as a member of an academic post-secondary faculty for
- 12 I am currently teaching this number of courses:
- 13 The average number of undergraduate and/or graduate students whom I teach in one semester is
- 14 My current email address is: (optional for entry into Amazon.com gift certificate drawing OR if you would consider being interviewed within this study)

☐ 1-2

☐ 0

☐ Active Leader

☐ Participant/Discussant

☐ Peripheral Observer

☐ Not a Member

☐ Yes - by choice

☐ Yes - by assignment

☐ No

☐ Professor

☐ Associate Professor

☐ Assistant Professor

☐ Full-time instructor

☐ Part-time instructor

☐ Female

☐ Male

☐ <30

☐ 30-39

☐ 40-49

☐ 50-59

☐ >59

 years

☐ 1

☐ 2

☐ 3

☐ 4

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Thank you !!

Thank you for your participation in completing this survey! You have been a valuable contributor to this research study and your efforts are most appreciated. Your email address will be entered into a random drawing for one of five \$25.00 Amazon.com gift certificates. Winners will be notified by email by May 23, 2005.

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You have come to the end of the survey.

If you want you can go back and modify your responses.

Or you can hit submit to complete the survey. Once you submit the survey you cannot modify it any more.

[Submit Survey](#)

APPENDIX E

FACULTY INTERVIEW PROTOCOL

FACULTY INTERVIEW PROTOCOL

The Process of Technology Adoption and Integration into Teaching and Learning by University Faculty

1. What was your motivation for first using technology on a personal level?
2. What do you feel is the most significant factor that augments your ability or desire to adopt and implement a technology innovation?
3. Conversely, what is the most significant factor that diminishes your ability or desire to adopt and implement a technology innovation?
4. How would you define technology integration for university faculty?
5. What was your motivation for first using technology in your teaching?
6. Could anything have caused you to become interested in the use of technology in your classroom sooner than you already have?
7. How would you describe your process along the journey of technology adoption and implementation in teaching and learning?
8. Do you rely more on institution-provided professional development or informal information from colleagues or other sources?
9. How important is it to you to be a part of a group of colleagues when learning about or experimenting with a technology innovation?
10. What do you feel are the most beneficial ways to collaborate with colleagues?
11. Are resources for technology more likely to be a barrier or a motivation for your use of technology in your classroom?
12. What role should technology integration play in faculty recognition or tenure and promotion?
13. Is technology use causing positive change in your classroom?
14. What is the likelihood of your continuing to seek out and adopt new technology skills to be used in your teaching, and if positive, what would help this happen?

APPENDIX F

SELF-SELECTED STAGES WITHIN THE TECHNOLOGY INTEGRATION PROCESS

SELF-SELECTED STAGES WITHIN THE TECHNOLOGY INTEGRATION PROCESS

The stage that best describes where I am within the technology adoption and integration into teaching and learning process is:

_____ **Awareness (Stage 1)**

(I am aware of technology and have some basic skills but do not think I have sufficient expertise to use technology without assistance. I rarely require the use of technology by students to complete assignments.)

_____ **Learning the Process (Stage 2)**

(I can use basic software and some standard hardware comfortably. My students use basic technology resources to occasionally complete assignments.)

_____ **Understanding and Applying the Process (Stage 3)**

(I use a variety of technology resources/tools in my preparation, instructional delivery, and evaluation. My students use a variety of technology resources/tools in the construction of curriculum-based products.)

_____ **Creative Application to New Contexts (Stage 4)**

(I am comfortable experimenting with various uses of technology for my teaching. My students are involved in using a variety of technology resources/tools in analyzing and synthesizing information.)

_____ **Facilitating the Process (Stage 5)**

(I am eager to share my teaching with technology experiences with my colleagues. I encourage student/faculty interactions in discovering and utilizing different technologies beneficial to learning.)

APPENDIX G

INSTITUTIONAL REVIEW BOARD APPROVAL FORM

IRB #: 2879

LSU Proposal #: _____

Revised: 03/24/2004

LSU INSTITUTIONAL REVIEW BOARD (IRB) for
HUMAN RESEARCH SUBJECT PROTECTION

Study exempted by
Office: 203 B-1 David Boyd Hall
Louisiana State University
Institutional Review Board
203 B-1 David Boyd Hall
578-8692; FAX 6792

APPLICATION FOR EXEMPTION FROM INSTITUTIONAL OVERSIGHT

Unless they are qualified as meeting the specific criteria for exemption from Institutional Review Board (IRB) oversight, ALL LSU research/projects using living humans as subjects, or samples or data obtained from humans, directly or indirectly, with or without their consent, must be approved or exempted in advance by the LSU IRB. This Form helps the PI determine if a project may be exempted, and is used to request an exemption.

Instructions: Complete this form.

If it appears that your study qualifies for exemption send:

- (A) Two copies of this completed form,
- (B) A brief project description (adequate to evaluate risks to subjects and to explain your responses to Parts A & B),
- (C) Copies of all instruments to be used. If this proposal is a part of a grant proposal include a copy of the proposal and all recruitment material.
- (D) The consent form that you will use in the study

to: ONE screening committee member (listed at the end of this form) in the most closely related department/discipline or to IRB office.

If exemption seems likely, submit it. If not, submit regular IRB application. Help is available from Dr. Robert Mathews, 578-8692, irb@lsu.edu or any screening committee member.

Principal Investigator Pam S. Nicolle Student? (Y)/N

Ph: 578-1246 E-mail nicolle@lsu.edu Dept/Unit ELRC

If Student, name supervising professor Dr. Yiping Lou Ph: 578-2987

Mailing Address College of Education, 115 Peabody Hall Ph: _____

Project Title Technology Adoption into Teaching and Learning By Mainstream University Faculty: A Mixed Methodology Study Revealing the How, When, Why, and Why Not

Agency expected to fund project none

Subject pool (e.g. Psychology Students) university faculty

Circle any "vulnerable populations" to be used: (children <18; the mentally impaired, pregnant women, the aged, other). Projects with incarcerated persons cannot be exempted.

I certify my responses are accurate and complete. If the project scope or design is later changed I will resubmit for review. I will obtain written approval from the Authorized Representative of all non-LSU institutions in which the study is conducted.

PI Signature Pam S. Nicolle Date 2/7/05 (no per signatures)

Screening Committee Action:

Exempted X Not Exempted _____ Category/Paragraph _____

Reviewer S. Kim MacGregor Signature S. Kim MacGregor Date 2/10/05

Part A: DETERMINATION OF "RESEARCH" and POTENTIAL FOR RISK

This section determines whether the project meets the Department of Health and Human Services definition of "research" and if not, whether it nevertheless presents more than "minimal risk" to humans that

VITA

Pamela Stone Nicolle was born on September 18, 1956, in Colorado City, Texas, the daughter of William Edward Stone and Lula Davis Stone. She earned valedictory honors at graduation from Winnsboro High School, Winnsboro, Louisiana, in 1974. She received a Bachelor of Science degree in elementary education in December 1977 from Louisiana State University, Baton Rouge. While teaching gifted resource education she pursued and was awarded a Master of Education degree from Northeast Louisiana University in August, 1984. Following eighteen years in K-12 education, she currently serves as an Educational Technologist in the College of Education at Louisiana State University, Baton Rouge.