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Practicing teacher perceptions of technology and technology integration in K-12 education

Stephanie Lyn De Jong

PRACTICING TEACHER PERCEPTIONS OF TECHNOLOGY AND TECHNOLOGY INTEGRATION IN K-12 EDUCATION

A Project

Presented to the

Faculty of

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In Partial Fulfillment

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ABSTRACT

The increased use of technology in schools brings the challenge of creating a common vocabulary of technology integration and what it looks like in a classroom. Several different ideas about integration exist. The following document is a study of practicing teachers' perceptions of technology and technology integration in K-12 education. This descriptive study aimed at measuring their ideas as they existed. The study was designed as a cross-sectional study. A survey was distributed to the participants to assess their perception of integration. Variables of interest including years of service, computer access and technology training, were also included to provide a means of determining the relationship between technology integration perceptions and a range of variables. The overall conclusion of this study reveals the lack of a common understanding of what technology is and what technology integration looks like in the classroom. This study shows an incongruent perception of these terms by teachers, researchers and the public in general.

ACKNOWLEDGMENTS

The creation of this thesis has been the result of various conversations with colleagues, practical classroom teaching experience, hours of research, and the input and guidance of my advisors and readers. I would like to thank Dr. Eun-Ok Baek, my first reader for challenging me, encouraging me and guiding me throughout the entire process. Her help was invaluable and instrumental while I formulated my ideas and sought to present them clearly and with validity.

In large part my interest in education and technology can be attributed to the mentors who have come alongside me in the teaching environment and challenged me with new ideas and worked with me to develop my own integration perceptions. Without their commitment to helping me develop my skills as an educator this thesis would never have been possible. I cannot overstate the impact these individuals had on my teaching experience.

Finally, a large undertaking like this can only be done with the sacrifice and support of family. I want to thank my husband and family for their constant support and encouragement throughout the entire process.

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CHAPTER ONE

INTRODUCTION

Overview

Technology has taken education by storm. 99% of America's public schools are connected to the Internet, 91% of classrooms are connected to the Internet and 96% of teachers report using the Internet as a teaching resource (Quality Education Data). By 2001, there was one instructional computer with Internet access for every 5.4 students (NCES). While this technology has its proponents and detractors, it is here to stay (Roybler, 1999) because the public wants it and believes in it (Rose, 2002). Congress and the President have responded to the public with the No Child Left Behind Act of 2001 (NCLB). As a result more money is pouring into classroom technology. Last year U.S. public school districts spent $6.45 billion for technology (Quality Education Data). Overall, there has been a steady increase in technology spending over the past 10 years (Children's Partnership, 1996; McKinsey & Company, 1995; NIIAC, 1995; PCAST, 1997). Spending for technology is not enough as the NCLB declares, "it's not enough to have a computer and an Internet connection in the classroom if they are not made part of the learning

process (http://www.nochildleftbehind.gov/start/facts/21centtech.html)." Teachers are expected to integrate technology, specifically in the form of computers and the Internet, to improve academic achievement (NCLB). However, without a common understanding of what technology integration means, it becomes increasingly difficult to measure success, make technology spending priorities and implement effective educational technology integration in the classroom.

Statement of the Problem

As educational technology spending and accountability increased, this set in motion a proliferation of technology literature. To date, most studies on educational technology integration have focused on availability of educational technology (Mageau, 1991), the success of implementation on academic outcomes (Schacter, 1999; Barron, Kemker, Harmes, Kalaydjian, 2003), barriers to integration (Addison & Woods, 1999; Hativa & Lesgold, 1996; Hadley & Sheingold, 1993), and instructional design theories (Nelson, 1999). Missing from the literature however is what practicing teachers perceive technology and technology integration to mean. Since teachers are in the classroom with students it is important to understand

their perceptions. It is crucial to understand teachers' perceptions especially considering the fact that there already exists a disconnect within the body of literature as to the definition of technology and its integration. Researchers using the narrowest context view technology mainly as computers and the Internet. Those with a broader view see technology as "embracing the changing of the natural world to satisfy our needs" (Rose, 2002). The question remains, what do practicing K-12 teachers understand these terms to mean? There is currently insufficient information on practicing K-12 teachers' perceptions of technology and its integration. Without this information it will be difficult if not impossible to establish a common dialogue on how integration impacts student achievement, where best to spend technology money and how best to support teachers better embedding technology in the teaching and learning process.

Purpose of the Study

Currently, teachers' perceptions of technology and technology integration are not fully understood (e.g., do teachers see technology as a tool or a process? does a teachers definition of technology affect the way they implement technology integration in their classroom? does

access to training play a role in perception?). This is to determine how K-12 teachers understand the term technology and technology integration. Variables of interest (e.g., years of service, age, gender, access to technology, previous technology training and current technology adoption levels in the classroom) were included to help examine the relationship between teachers' perceptions and the variables. Every effort was aimed at measuring perceptions as they existed. Furthermore, the primary research question focused not only on how teachers perceived technology and technology integration, but how their current adoption of technology in the classroom relates to their stated definition. The research question of this study is: What are practicing teachers' perceptions of technology integration in K-12 education by years of teaching experience, age, gender, access to technology, previous technology training and level of technology adoption in the classroom?

Significance

Clearly defining K-12 teachers' perceptions of technology and technology integration will provide a valuable informational base upon which to begin building a common vocabulary. An understanding of teachers'

perceptions will help researchers better assess technology barriers, design instructional theories, evaluate successful implementation of academic outcomes, and design pre-service teacher programs. Just as it is difficult to communicate without a common language, it will be difficult to advance technology integration in the classroom unless researchers and teachers are talking in the same language. Finally, programs promising to help teachers increase technology integration must start with a specific definition of what technology integration means to teachers. This study is designed to provide such an understanding.

Limitations

Every effort was made to design and develop valid procedures in this study; however, the nature of a descriptive study often represents only suggestive evidence of a casual connection. Therefore this study is a good starting point for more detailed research. Furthermore time constraints limited the scope of the sample and the type of study that could be conducted. A final constraint in this study is the difficulty of measuring complex human thinking and nuisances in a survey format.

Definition of Terms

Technology - the process used to construct solutions to problems

Technology Integration - a change in pedagogy which uses technology to achieve increasingly complex outcomes

CHAPTER TWO

REVIEW OF THE LITERATURE

Introduction

This section reviews the existing body of literature as it relates to technology and technology integration in education. The review summarizes previous research and analyzes how the present study relates to studies already existing. Two goals for this literature review are to critically analyze previous literature to support the need for this study and with the understandings of previous studies to better equip the researcher gain a deeper understanding of the phenomena.

Technology in Education

Technology in education can be classified in three broad stages (Reiser, 2001). Stage one, beginning as early as 1908, emphasized visual instructional media and instructional films. Early proponents believed this new technology would revolutionize education. "In 1913, Thomas Edison proclaimed, 'Books will soon be obsolete in the schools.... It is possible to teach every branch of human knowledge with the motion picture'" (Reiser, 2001). The second stage, beginning in the 20's and 30's, emphasized radio, films and television. It was believed that radio as

a medium would revolutionize education. "The National Educational Association stated, 'Radio, films and TV will be as common as the book and as powerful in their effects on learning and teaching'" (Reiser, 2001). The third broad stage began in the 1950's with the computer; however, it wasn't until the 1980's that computer technology was integrated into the classroom environment. "By January 1983, computers were being used for instructional purposes in more than 40% of all elementary and more than 75% of secondary school in the U.S." (Reiser, 2001). Today, 99% of America's public schools are connected to the Internet, 91% of classrooms are connected to the Internet and 96% of teachers report using the Internet as a teaching resource (Quality Education Data). By 2001, there was one instructional computer with Internet access for every 5.4 students (NCES). And as was the case with the introduction of prior technologies, it was believed that computers and the Internet were going to be the "magic bullet" to solve many educational problems (Thompson, 1996).

As with prior technologies, the introduction of computers into the classroom did not immediately and drastically improve students learning; as a result, researchers began to change their focus from studies quantifying the numbers of computers or Internet access

per student (Barron, 2003) to investigating how technology is integrated into the classroom (Barron, 2003). This shift in focus from viewing technology as 'machinery' to viewing it as 'a process' (Kozma, 2000) created a gap in the common understanding of the term technology. It is this gap which creates a tension between what currently exists and the ideal future that is desired (Nelson, 1999). "It is this gap that generates energy for change. If there were no gaps, there would be no need to create a better reality" (Nelson, 1999).

What is Technology?

Often when new technology is introduced the focus is on the machinery itself. "So, what comes to mind when you hear the word technology? Do you immediately think of computers, scanners, digital cameras, cell phones and other gizmos?" (Pershing, 2000). The ITEA along with the Gallop Organization (Rose, 2002) conducted a national survey to determine the publics' perception of technology. In the poll, "When hearing the word technology, approximately two-thirds (63%) think of only computers and matters related to the Internet..." (Rose, 2002). "This narrow context in which technology is viewed seems to place the public at odds with the definition favored by

experts... that being that technology embraces the changing of the natural world to satisfy our needs" (Rose, 2002). Technology is more than machines; it is a process. The Gallop Poll showed that only one-third of the public (36%) viewed technology in this broader context (Rose, 2002). In its broad context, technology refers to an approach to solving problems in the home, school or work place. The Latin root of the word technology "texere" means "to weave or construct (Pershing, 2000); thus, technology is the process we use to construct solutions to problems. Often this process involves creating machines to enable changes of the natural world to meet our needs. Computers are one such example; computers have solved many problems of communication, access to and processing of information, and as yet to be determined improvement in the teaching and learning processes.

A review of the literature reveals both a narrow and broad view of technology. Historically, many studies have focused on numbers of computers per student or numbers of computers with Internet access in the classroom (Barron, 2003). In addition this narrow view is often seen in textbooks designed to introduce educators to technology. Many of these books strongly emphasize computer skills and use (Wissick, 2002). In addition "The International

Society for Technology in Educations National Educational Technology Standards project is leading the nation in making teachers...more aware of the need to develop their basic computer and technical skills" (Pitman, 2002). This emphasis on a "laundry list" of computer skills reveals a narrow view of technology.

On the other hand, Solomon (2002) states "...technology is the systematic application of science which emphasizes the utilization of scientific knowledge and principles." "Finn (1962/1996) believes that technology was a way of thinking about certain classes of problems and their solutions (Solomon, 2000). As technology relates to educational pedagogy, Scheingold (1991) says technology is a change in the teaching process; it is the transformational, seamless application of technology to support goals related to increased involvement with complex authentic tasks. Recently, research has been conducted more broadly on the process of technology integration, research and development (Kozma, 2000). As the educational literature focuses more on the process of technology, the emphasis has shifted from measuring "machines" to evaluating the process of integrating technology in the classroom.

What is Technology Integration?

A broad definition of technology integration is a change in pedagogy which uses technology to achieve increasingly complex outcomes. Dockstader (1999) suggests a useful definition, that is to say, an effective and efficient use of technology in the general content areas which provide learners with opportunities to apply computer skills in meaningful ways. Rather than having technology drive the curriculum; curriculum should drive technology usage.

In order to integrate new technology in the classroom, it is necessary to change the way things have been done in the past. As Welch (2002) states, "...when new technology is introduced, a major challenge is to develop a framework that can be used to implement the new tool or process." McKenzie (2002) believes "few teachers are naturally equipped to make productive use of new technologies, often requiring 50-100 hours of intensive adult learning to grasp the potential of new technologies to transform student learning." He goes on to say that many teachers require 30-90 hours of training within their curriculum context before they are able to successfully implement technology at a high level (McKenzie, 2002). Yet, Windschill (2002) verifies that teachers "can and do

change their instructional practices when using technology [especially desktop computers."

Much of the research in the field of technology integration takes the "stage" approach. This approach recognizes that change does not take place overnight. It presumes that learners (in this case, teachers) progress through a level of stages before they are able to fully adopt and integrate technology in the classroom. Everett M. Rogers (1995), in Diffusion of Innovations broke this process down into five stages though which the individual makes changes. His first level is The Knowledge Stage. This is when a teacher is aware that technology exists but does not personally use it. Level two is The Persuasion Stage. This is when teachers encounter other colleagues using technology and begin to observe how the new technology can be useful in common teaching tasks such as grading programs. At this state, there is no infusion of technology into the curriculum. Third stage is The Decision Stage. In this stage teachers either embrace the new process or reject it. If they chose to embrace the change, they begin to use technology to gain more information on content and begin to see links between content and technology. In this stage teachers begin to use technology as a teaching tool such as PowerPoint.

Fourth is The Implementation Stage. This is where teachers shift from using technology to support their needs and begin to view and use technology to help students gain more complex learning outcomes. Often times in this stage, students will begin to use the technology to gather information (Internet), process information (word processing) and present findings (PowerPoint). The fifth and final stage is Confirmation. This full implementation stage is where teachers not only collaborate with other colleagues using technology, but they also begin to invent and create new applications of technology to enhance learning in the content area.

Much of what is known about teachers integrating technology in the curriculum comes from the Apple Classroom of Tomorrow (ACOT) project. From this study, data have been growing since the mid 80's. The study was intended to create a technology rich environment so teaches could experiment with the integration process. From this research a model of adoption was created. This again emphasizes a "stage" approach to technology integration. Five levels of adoption were created as a result of ACOT. They are:

1. Entry - teacher struggles to deal with technology

2. Adoption - teacher uses technology at a basic level
3. Adaptation - teacher begins to experiment with new technology
4. Appropriation - teacher feels comfortable with technology
5. Invention - teacher experiments with new technology and content integration (ACOT)

Continuing the list of studies, Bradshaw (2002) discusses "The Concerns-Based Adoption Model (CBAM) as another approach to measuring the developmental process of technology adoption and integration and Goddard (2002) describes a theory known as "Relate-Create-Donate."

Within the stage approach, many studies have been conducted to access barriers to progressing from one stage to the next. Studies have focused on barriers such as limited equipment, training and time (Hadley & Sheingold, 1993; Ringstaf & Yocan, 1994), as well as teaching methods and beliefs about technology (Hannafin & Savenye, 1993; Addison, Lane, & Woods, 1999). First order barriers have been distinguished from second order barriers and emphasis has been placed on understanding these phenomena.

Besides these stage approach studies, several instruments have been developed to measure technology

integration. The LoTiQ's main purpose is to use the stage approach to measure technology integration, while other instruments such as CTAP and the Mankato survey emphasize computer skills (Moersch, 2002).

Finally, some researchers dispute the very idea of "stage" integration believing that these linear approaches are problematic. Windschitl (2002) suggests that teachers may be on different levels at the same time during the progression process. This non-linear approach takes into account a wider range of variables explaining the adoption/integration process.

The previously sited studies focus on levels of integration, the process of integration and barriers. Missing from the literature, however, is a study of what teachers perceive technology and technology integration to mean to them. It is unclear whether the results reported in these studies would differ based on teaches perceptions.

Studies Related to Teacher Perception of Technology and Technology Integration

Recent research has focused on the stages and outcomes of technology integration in the classroom. A limiting factor has been the difficulty in defining and measuring teachers' perceptions. In order to better

understand these complex phenomena, different research methods have been used. Addison, Lane and Woods, in their article *Examining Teachers' Beliefs about the Role of Technology in the Elementary Classroom* (1999) conducted interviews, observations and surveys. Others rely solely on survey data (Barron, Kemker, Harmes, & Kalaydjian 2003; Oh & French, 2002; National Center for Education Statistics, 1999; Center for Research and Information Technology Organization, 2001), and interviews (Cope & Ward, 2002). One of the largest studies was the Apple Classroom of Tomorrow (ACOT). This longitudinal study relied on observations, weekly journals and reports to collect data. The current study uses a survey style format for gathering information. This type of instrument is useful in describing the characteristics of a large population. No other method of observation can provide this general description. In addition, a survey allows for flexibility in the creation stages when deciding how best to administer it. Finally, surveys often make data analysis more precise.

CHAPTER THREE

METHODOLOGY

Introduction

A survey to a group of K-12 teachers was conducted within a large central school district in Southern California. This likert style questionnaire explored K-12 teachers' perceptions of technology and technology integration. Surveys were distributed at 6 school sites (two elementary schools, two middle schools and two high schools) during a one-week period. The survey was voluntary. This study is basically qualitative in the sense that it aimed at understanding teachers' perceptions. Permission for distribution of the survey was obtained through the universities Institutional Review Board, the school district and the principal at the local school sites.

Participants

Several school sites within a large central city school district in Southern California were selected for this study. The district serves 19,122 students; approximately 23% of the students are eligible for free and reduced-price lunches (NCES, 2001). Overall there are 19 schools (12 elementary, 4 middle schools, and 3 high

schools) within the district boundary (AUSD, 2001). One full time technology coordinator is at the district level and offers technology training at different school sites throughout the year. At the time this survey was conducted, the district averaged the following student to computer ratio: 6.7% elementary schools; 7.4% middle schools; and 4% for high schools (NCES, 2001).

The sample of 127 respondents represents an overall response rate of 37% of which 32% are male and 68% are female. They represent a range of variables including age and teaching experience, access to technology, use of technology and varied previous technology training.

Of the respondents, 20% taught in elementary school, 31% in middle school and 49% high school. Across all three-school levels approximately 46% had taught for 11 or more years. The survey asked respondents to state their age by category (20-29 years, 30-39 years, 40-49 years and 50 + years) results are reported in Table 1.

Table 1. Respondents by Variable

School Level	# of Participants	Yrs Teach Experience			Age			
		1-5	6-10	11+	20-29	30-39	40-49	50+
Elementary	20%	46%	12%	42%	23%	27%	23%	27%
Middle	31%	36%	20%	44%	28%	21%	28%	23%
High	49%	31%	19%	50%	13%	22%	31%	34%

Research Design

This is study using a likert style survey. Data was colleted using a questionnaire. This design was selected for its ability to reveal diverse understandings of terminology. This is particularly valuable because this area of inquiry is relatively new. The research will describe existing ideas of technology and technology integration in K-12 teachers. This design makes no attempt to measure change in teacher perceptions but aimed at measuring their ideas as they existed.

Development of the Instrument

In order to investigate the complex ideas of teachers with as little bias as possible, a two-phase development process was implemented. Phase one: preliminary study conducted using only open ended questions. Second phase: likert questionnaire developed.

Phase One: The preliminary study was conducted in the winter of 2003; it was exploratory in nature and not guided by hypothesis. In an exploratory study, the researcher is open to new findings and patterns that may emerge during the study. This was done since there was insufficient understanding of the phenomena under study. An open-ended survey was used to collect data. A survey

was given to graduate students, including many K-12 teachers in a Southern California university program. The total number of 71 (61 were used for the data analysis) teachers out of 145 (40%) teachers responded in the selected courses in the program. The purpose of the survey was to gather a broader understanding of teachers' perceptions. Once the survey questionnaire was created, it was pilot-tested with an experienced teacher and revised several times with the consultation of an expert researcher. Then, an e-mail asking for participation in the survey was distributed to a mailing list. The data were collected in a web-based format. E-mail was used for introductory remarks and for providing the web survey link. During the data analysis process, attention was paid to emerging themes and patterns from the data as recommended by Lincoln and Guba (1985).

Phase Two: Once preliminary survey data was evaluated the information was used to help create a likert instrument. Questions were developed from preliminary survey data, a set of objectives and pre-designed categorizations. The categorizations acted as a focal point for the survey. They were: Peripheral integration, transitional integration, internalized integration, and transformational integration. Questions were limited to a

single idea or concept, negative items were avoided, biased terms were excluded as much as possible and questions were designed to be as short and simple as possible. (259) A likert-type scale was used to measure respondents answers. Following the same process as the preliminary survey, the questionnaire was pilot-tested with an experienced teacher and revised several times with the consultation of an expert researcher. Feedback from participants comments indicated valuable information on changes needing to me made for reliability. The survey instructions were also simplified and the survey was shortened to make it more likely that busy teachers would participate.

The final survey consisted of three pages. The first page solicited demographic information from participants and contained the open-ended portion of the questionnaire. This was done to illicit responses from teachers without bias from the following likert questions. The remaining pages addressed the pre-designed categorizations and objectives (access to technology, previous training, and level of technology adoption in the classroom).

Data Collection and Analysis

Permission for distribution of the survey was obtained through the universities Institutional Review Board, the school district and the principal at the local school sites. Prior arrangements were made with the respondents to complete the survey within a set school week. The respondents were not asked to state their names but were asked to give information on a set of variables such as age groups, teaching experience, prior technology training and use of technology in the classroom. They were free to participate and not penalized by the administration for refusal to participate. Next, a cover letter for participation in the survey was distributed to teachers at the selected school sites. The survey was administered to all respondents in the same one-week period. In order to reduce the number of non-respondents, daily reminder announcements were made on the school's P.A. system. Also, a mid-week reminder letter with candy was distributed to the teachers' boxes.

The survey included questions directly related to the pre-selected categories. Teachers responded on a 6-point scale to item such as those shown in Table 5.

Table 2. Teachers Perceptions of Technology Integration Survey

Instructions: Select one answer for each item to indicate how you feel.

1 = Strongly Disagree 2 = Disagree 3 = Somewhat disagree
4 = Somewhat Agree 5 = Agree 6 = Strongly Agree

1. I am aware that technologies exist but have not used it.	1 ☐ 2. ☐ 3. ☐ 4. ☐ 5. ☐ 6. ☐
2. I am anxious about the prospect of using technology.	1 ☐ 2. ☐ 3. ☐ 4. ☐ 5. ☐ 6. ☐
3. I do not believe I have sufficient expertise to use technology without assistance.	1 ☐ 2. ☐ 3. ☐ 4. ☐ 5. ☐ 6. ☐

The questionnaire was divided logically and practically into different sections/categorizations. The analyses are based on classroom teacher responses only; responses from other school personnel (counselors, vice principals) were excluded. Descriptive data were analyzed by percentages while inferential data were analyzed (using SPSS for Windows version 11.5) using the Pearson product-moment correlation. This statistical measure was used to assess the degree of the relationship between the data collected.

CHAPTER FOUR

FINDINGS AND RESULTS

Introduction

This study was constructed to identify a broad overview of teachers' perceptions of technology and technology integration. Descriptive analysis was used to analyze responses from participants in an effort to better clarify what they mean by these terms. When describing technology, the research supports 3 levels of understanding for the term technology and 4 levels of understanding for the term technology integration. A second purpose of the study was to show the relationships between these perceptions and different variables such as age, gender, access to technology and level. These data will be discussed and compared with other research studies.

Presentation of the Findings

Teacher use of Technology

Survey data indicate that on average, 79% of teachers have been a frequent user of technology for over 3 years; 46% of teachers surveyed stated they have used technology in the classroom for over 3 years as well (Table 3).

Table 3. Teacher use of Technology by Individual and Within a Classroom Setting

	%Individual use of Technology			
	0-3 mos	3 mos-2 yrs	2-3 yrs	3+
Elementary	0	8	23	69
Middle	8	5	2	85
High	0	6	6	88
	% Within Classroom Setting			
	0-3 mos	3 mos-2 yrs	2-3 yrs	3+
Elementary	0	0	23	42
Middle	28	28	10	36
High	10	10	13	61

Based on this data, it would appear that participants were comfortable with technology. Given this fact, it is interesting to note that the use of technology had no significant relationship with teachers' definition of technology or technology integration. While other studies have shown that the increase use of technology does have an impact on bringing about additional use of technology (Buck & Horton, 1996), this study reveals that simply using technology is not sufficient to bring about a change in conceptual thinking about the terms technology and technology integration.

How do Practicing K-12 Teachers Perceive Technology?

In general, participant responses support three definitional understandings of the term technology. Two categories revealed a narrow understanding of the term and the third category revealed a broader view. The three categories are:

1. Tools/machinery
2. Use of tools
3. Knowledge/process.

The majority fall in the first two narrow categorizations (85%) while only 15% show a broader definitional understanding of technology. Forty percent of teachers view technology as tools and machinery. Sample respondent answers are: "technology is anything mechanical," technology is "computers, CD players, tape players or a 35 mm camera," and technology is "anything that has batteries or has to be plugged in." Respondents in this category made no distinction between the tools themselves and the use of the tools for a purpose. Simply identifying a piece of machinery was, in their understanding, sufficient to define the concept of technology.

An additional 45% of teachers view technology as the use of machinery. Sample respondent answers in this category are: "technology is any electronic device which assists in the learning process," technology is "the use of computers, cameras, discs, or tapes to enhance student learning," and finally, "application of scientific devices for practical uses." Those respondents in this category express a definitional understanding of technology as it relates to the use of machines or tools to accomplish a goal. They see technology as any man made device that facilitates accomplishment of an objective.

Finally, 15% of respondents view technology as knowledge or a process. Sample respondents said, technology is "the use of science applications to further the knowledge of mankind," and technology is "advances in science that helps us to solve problems," and finally, technology is "the application of science and discovery to meet the ever changing needs of the human society." Those respondents with the broadest view of technology do not mention machinery or tools; instead, they view technology as a process used to solve problems. Interestingly, those respondents in this category did not mention any particular tool or device; but, saw technology as a much larger process.

An examination of teacher's definition of technology and several variables (age, gender, years of teaching experience, level) shows no significant relationship. While no other studies exist on this relationship, in their research Buck and Horton (1996) demonstrate the lack of a significant relationship between technology use and these same variables (age, gender, years of teaching experience, level).

Table 4. Teacher Perception of Technology by Age and Gender

	Age				Gender	
	20-29	30-39	40-49	50+	M	F
Tools/Machinery	8	11	11	11	12	29
Use of Tools	10	9	15	9	12	31
Knowledge/Process	1	3	4	8	8	8

Table 5. Teacher Perception of Technology by Teaching Experience and Level

	Yrs Teach Experience			Level		
	1-5	6-10	11+	Elementary	Middle	High
Tools/Machinery	15	9	18	12	10	18
Use of Tools	14	8	21	10	9	25
Knowledge/Process	4	3	8	4	5	7

Table 6. Table 8: Teacher Perception of Technology by Individual use of Technology

	%Individual use of Technology			
	0-3 mos	3 mos-2 yrs	2-3 yrs	3+
Tools/Machinery	2	3	3	33
Use of Tools	1	4	3	36
Knowledge/Process	0	.5	.5	14
	% Within Classroom Setting			
	0-3 mos	3 mos-2 yrs	2-3 yrs	3+
Tools/Machinery	5	11	5	19
Use of Tools	4	5	6	28
Knowledge/Process	3	1	4	9

How do Practicing K-12 Teachers Perceive Technology Integration?

After analyzing the data, participant responses support the emergence of four definitional understandings

of the term technology integration. The largest numbers of participants fall in the first two narrow categories (58%), while 42% show a deeper understanding of the term technology integration. The four categories of technology integration that emerged from the data are:

1. Peripheral
2. Transitional
3. Internalized
4. Transformational.

Peripheral Integration

Among respondents 38% are at the peripheral integration level. This level of integration is on the margin. It is the stage where teachers are gaining a basic knowledge and comprehension of technology. They would be considered entry level participants with many barriers to overcome. Teachers often struggle to cope with technology in this phase. Examples of technology use at this level would include teachers finding lesson plans on line or typing out a lesson plan on a word processor. In this level teachers often believe it takes more time to do tasks with technology than without. They never use technology with students. Sample responses in this category were: technology integration is "using electronic equipment" and "using computes and other AV/devices."

Other responses which characterized this level of integration include vague statements such as, "use of computers, software and other electronic equipment in your curriculum," and "using technology throughout the core curriculum." Those respondents with vague definitional answers were put in this early level integration because they did not specify how or why they would use technology; furthermore, they did not specify whether they would use the technology personally or have the students use the technology. It was the researchers understanding (based on reviewing all the responses) that those teachers with this vague response were able to give the "conditioned/expected" response to technology integration without having clearly experienced it in their own lives or classrooms.

Transitional Integration

Based on their responses 20% of respondents are at this level. This level of integration is where teachers move from successfully using technology at a basic level to the phase where they begin to experiment with new technology and its application in the classroom. They would be considered adoption/adaptation level participants who apply technology as a teaching tool. Examples of technology use at this level would include teacher use of

software applications such as PowerPoint in presenting notes or concepts, teacher use of e-mail to communicate with other colleagues, teacher use of a digital camera, basic student assignments on the computer such as research or drill and practice exercises. In this level teachers integrate technology into the traditional classroom practices for personal use in teaching a lesson. Sample responses in this category include, "use of technology for curriculum instruction in multiple subject areas," and "use of tools to enhance and deliver classroom instruction," and finally, "using technology to support classroom management/instruction."

Internalized Integration

Among the respondents 24% were characterized as having internalized integration. At this level teachers would find it difficult or impossible to teach students without the use of technology. It is the stage where teachers engage in appropriation, invention, analysis, synthesis and evaluation of technology use. The teacher understands technology and works with it constantly. They are not afraid to experiment with new technology or teach technology to others. They are able to plan appropriate uses for technology and new instructional patters emerge as a result. In this stage teachers also begin to design

and implement new environments for learning where technology is used effortlessly as a tool not only by the teacher but by students as well. When technology has been internalized by the teacher they encourage all students to utilize technology and routinely integrate technology in the classroom or lab environment. They routinely use technology to make it possible for learners to acquire the basic content and skills with more depth. They use technology to develop high order thinking skills as students construct knowledge. At this level teachers go beyond existing ideas of how to use technology in the classroom and take risks to take advantage of technology use in new settings. Responses that fit this category include: "having students use cameras for class projects," and "using on line programs, using PowerPoint and web pages to demonstrate knowledge."

Transformational Integration

Finally, 18% of respondents showed a transformational level of integration. At this level of integration students would find it difficult or impossible to complete assignments without the use of technology. It is the stage where students engage in appropriation, invention, analysis, synthesis and evaluation of technology use. Motivation for self-directed learning and constructivist

approaches increase. Student ownership of learning improves and student achievement increases. Students understand technology and work with it constantly. They are not afraid to experiment with new technology. At this level students internalize integration and use it effortlessly as a tool for learning. Examples of this include student creation of on-line web quests, on-line quizzes, student developed web sites related to content, and student developed lessons for class presentation. Responses representative of this category include: "the planned or systematic combination of electrical or electronic devices with any teaching and learning activities. It's use facilitates and enhances learning and communication," and "students either presenting information, still pictures or moving pictures to present a concept, make a point, or contrast two ideas, or students discovery of information," and "using various instruments to make information, activity, more meaningful, useful or enjoyable," and finally, "utilizing the currently available assistive machinery (i.e. computers, robots) to aid in the teaching and learning process."

An examination of teacher's definition of technology integration and several variables (age, gender, years of

teaching experience, level) shows no statistically significant relationship.

Table 7. Teacher Perception of Technology Integration by Age and Gender

	Age				Gender	
	20-29	30-39	40-49	50+	M	F
Peripheral	5	10	12	11	9	29
Transitional	4	4	6	5	7	11
Internalized	5	4	4	12	9	17
Transformational	3	6	7	2	8	10

Table 8. Teacher Perception of Technology Integration by Teaching Experience and Level

	Yrs Teach Experience			Level		
	1-5	6-10	11+	Elementary	Middle	High
Peripheral	12	5	22	16	8	15
Transitional	6	5	6	4	3	12
Internalized	10	6	10	4	8	13
Transformational	6	2	10	2	6	9

Table 9. Teacher Perception of Technology Integration by Individual use of Technology

	%Individual use of Technology			
	0-3 mos	3 mos-2 yrs	2-3 yrs	3+
Peripheral	.5	3	4	32
Transitional	.5	2	.5	15
Internalized	.5	3	2	20
Transformational	0	.5	5	16
	% Within Classroom Setting			
	0-3 mos	3 mos-2 yrs	2-3 yrs	3+
Peripheral	4	6	5	24
Transitional	3	4	2	10
Internalized	3	4	6	11
Transformational	3	2	2	11

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

Introduction

Technology in the classroom is here to stay because the public wants and believes in it. Both the public and Congress expect teachers to integrate technology in the teaching and learning process; however, without a common definition of technology it is difficult to assess how effective technology is being integrated and how effective it is in improving student outcomes. In order to better assist teachers in this process of integrating technology, it was necessary to understand what they meant by technology and technology integration. Without a clear understanding of what these terms mean to them, it would be difficult if not impossible to assist them by creating staff development or teacher training programs to expand their knowledge of and adoption of technology.

Conclusions

This study was constructed to obtain a broad overview of teachers' perceptions of technology. The results show that while the majority of teachers indicated frequent use of technology for over three years (79%) they do not have a broad understanding of the term technology or a

transformational view of technology integration in the classroom. This study was also designed to investigate the relationship between different variables and teachers' perceptions of technology and integration. The results of the study indicate that teacher age, teacher gender, years of teaching experience, access to technology, previous technology training, and current use of computers in the classroom were not significantly related to the teacher's definition of technology or its integration. These findings are consistent with those of Buck and Horton (1996).

The results of this study indicate two important findings that need to be addressed. First, since the frequent use of technology does not significantly affect teachers' definitional understanding of the term technology and technology integration, new ways of changing teacher perceptions need to be developed and implemented. Too often in the past the sole attempt has been to put computers in a classroom and providing training on how to use them. Clearly this will not impact the larger issues of perception. A clear understanding of technology and technology integration is foundational in helping teachers understand where they are and where they are going in this revolutionary time. Not giving them the

knowledge to change their perceptions is tantamount to telling someone to fly a plane without instructions. If the public and Congress expect to see results from the implementation of technology they will need to address this issue by spending less money on hardware and more money on training and in-service programs as well as peer use programs.

The second implication of this study deals with the lack of a common understanding of what the term technology and technology integration means. Only 15 % were classified as having the broadest definition of technology. The issues of definitional differences described in this study are important because if teachers are not made aware of the changes that come with the use of technology, they are more likely to resist the process. Also, with such a narrow view of technology they are oblivious to larger implications of its integration and how it will radically change the process of teaching and learning. If they see it as an add-on rather than a facilitation of change in the entire field integration will not be successful. And if teachers are not clear on what technology is, how do we expect them to implement it in the classroom effectively? Technology is not self implementing. More needs to be done to help teachers

completely and effectively integrate technology in the classroom. Teacher pre-service programs should be constructed so as to focus on these terms and staff development should focus on the design of instructional theories rather than simply how to use a computer.

When teachers understanding of technology and technology integration are broadened, we hope they will be able to effectively meet the challenges of the NCLB Act. When Congress, individual school districts, and pre-service institutions focus attention on these valuable concepts teachers will finally be equipped and supported to successfully use technology to transform the teaching and learning process.

Limitations of Study Design and Procedures

Some limitations of this study should be noted. First, this study included a small sample size which may limit its generalizability. Only teachers from selected schools within one school district participated. A wider sampling of teachers in different districts and states may provide a broader understanding of teacher perceptions. Because this school district did not offer a wide variety of technology training to its teachers, a sampling of

districts which approach technology training in a more comprehensive way may also provide different information.

Second, survey results rely on self reported data and one might predict that those teachers who already had an interest in technology were more likely to respond to the survey than those who did not have an interest. In addition, self-reported data may contain intentional deception, reflect poor memory, or misunderstanding of the question which would be a factor in data inaccuracies.

Third, this survey was conducted over a short period of time. Given the fact that technology is rapidly changing and teachers' access to technology in the classroom is expected to increase over time, this study was only able to view a tiny part of the process. A longitudinal study may reveal a pattern of technology definitions and integration based on a variety of constantly changing factors.

Finally, the definition of terms continues to pose problems for practitioners and researchers evaluating this phenomenon. Little agreement has been reached on what constitutes technology and technology integration (Rose, 2002). In light of these problems, the current survey was created with as few assumptions as possible; however, the

likert style questions may have tainted respondents' perceptions.

Future Research and Recommendations

Based on the literature review and this study, the following suggestions for further research are made. From this study, it is clear that teachers' perceptions of technology vary widely. Observations and interviews combined with survey information would allow a broader understanding of teachers' perceptions through triangulation.

Further research involving pre-service teacher training programs and their effect/impact on teacher's definition and integration of technology would be useful. Without knowing how teacher training programs define technology and technology integration it would be difficult to assess if teachers are missing the broader definition in their classes or if the definition is not being taught.

APPENDIX A

IRB APPROVAL LETTER

CALIFORNIA STATE UNIVERSITY
SAN BERNARDINO

5500 University Parkway, San Bernardino, CA 92407-2397

Date: January 23, 2004

CSUSB
INSTITUTIONAL
REVIEW BOARD
Exempt Review
IRB# 03052
Status
APPROVED

Ms. Stephanie Lyn De Jong
c/o: Prof. Eun-Ok Baek
Department of Science, Math, & Technology
California State University
5500 University Parkway
San Bernardino, California 92407

Dear Ms. De Jong:

Your application to use human subjects, titled, "Practicing Teacher Perceptions of Technology Integration in K-12 Education" has been reviewed and approved by the Institutional Review Board (IRB) of California State University, San Bernardino.

You are required to notify the IRB if any substantive changes are made in your research prospectus/protocol, if any unanticipated adverse events are experienced by subjects during your research, and when your project has ended. If your project lasts longer than one year, you (the investigator/researcher) are required to notify the IRB by email or correspondence of *Notice of Project Ending* or *Request for Continuation* at the end of each year. Failure to notify the IRB of the above may result in disciplinary action. You are required to keep copies of the informed consent forms and data for at least three years.

If you have any questions regarding the IRB decision, please contact Michael Gillespie, IRB Secretary. Mr. Gillespie can be reached by phone at (909) 880-5027, by fax at (909) 880-7028, or by email at mgillesp@csusb.edu. Please include your application identification number (above) in all correspondence.

Best of luck with your research.

Sincerely,

Joseph Lovett, Chair
Institutional Review Board

JL/mg

cc: Prof. Eun-Ok Baek, Department of Science, Math, & Technology

APPENDIX B

PILOT SURVEY

Your Perceptions of Technology Integration

This study is to understand how you understand the term technology integration so that teacher educators and/or etec faculty may better understand exactly what its definition means to you. By defining integration clearly, you will be able to learn how to better embed technology in the teaching and learning process. The survey consists of three parts with a total of nine questions. It would take about 15 minutes to complete. Once you complete the form, please click the submit button at the end of this survey. Your thoughtful input would be much appreciated. If you have any questions, here is my contact information.

Eun-Ok Baek, Ph. D.
Assistant Professor
Instructional Technology, UH 401.17
(909)880-5454; ebaek@csusb.edu

Part A: Demographics

Total Year of Teaching: [ ]

Level: ○ K to 6 ○ Gr. 7 to 10 ○ Gr. 10 to 12 ○ Higher Ed
○ Other (Please specify.): [ ]
Primary Discipline to teach: [ ]
Gender: ○ Male ○ Female
Age: _____
Which program are you in? ○ Credential program ○ ETEC program
Which course are you currently taking? Select all that is applicable. ○ 500 ○ 537 ○ 546 ○ 676
○ Others (Please specify.) [ ]

Part B: Technology Integration

1. What is your definition of Technology?

[ ]

2. Please give me some examples of technology that you are most frequently using in the classroom you teach. If you don't have a classroom yet, what kind of technology you would use most frequently when you teach.

3. Why do you use those technologies?

4. What is your definition of Technology Integration?

5. Please give me some specific examples of how you integrate technology in your classroom if you h
If you don't have a classroom yet, how you would integrate technology once you have a classroom.

Part C. Computers in Your Classroom

6. Please tell me about computers in your classroom, if you have one, by answering the following.

a) How many computers are allocated to your classroom?

b) The numbers of the computer platforms: Windows Mac

c) The numbers of the operating System:

Windows 95 98 NT XP Millennium

Mac OS8 OS9 OS10

d) How many of those computers are connected to the Internet?

7. How do you use computer technology in your classroom? Please give me some specific examples of computers in your classroom as many as you could.

Part D: Computing Training

8. Have you ever taken any computing training session?

○ Yes ○ No

8.1. If YES, what are those courses?

9. Have you ever been requried to use technology in your teacher credential programs?

○ Yes ○ No ○ N/A

9.1 If YES, what are those courses?

Thank you for your time!

APPENDIX C

QUESTIONNAIRE INSTRUMENT

Teacher Perceptions of Technology Integration

This study is to understand what you think about the term technology integration so that teacher educators and/or credential program teachers may understand what the term technology integration means to you. By defining integration clearly, you will be able to learn how to better embed technology in the teaching and learning process. This survey will take about 5-7 minutes to complete.

Part A: DEMOGRAPHICS

1. Gender: _____ 2. School site: _____

3. Age:
   ☐20-29 ☐30-39 ☐40-49 ☐50+

4. Years of teaching experience:
   ☐1-5 years ☐6-10 years ☐11+ years

5. Level taught - select all that apply:
   ☐K-6 ☐7-8 ☐9-12 ☐Other: _____

6. Primary discipline taught - select all that apply:
   ☐K-6 ☐English ☐Social Studies ☐Foreign Language
   ☐Science ☐Math ☐Other: _____

Part B: TEACHER PERCEPTION

1. What is your definition of Technology?

_____

_____

_____

_____

_____

2. What is your definition of Technology Integration?

_____

_____

_____

_____

_____

Part C: Teacher Use

1. Which best describes how long you have been a frequent user of technology?
   ☐0-3 months ☐3 months–2 yrs ☐2-3 years ☐over 3 years

2. Which best describes how long you have been an active user of technology in your classroom?
   ☐0-3 months ☐3 months–2 yrs ☐2-3 years ☐over 3 years

Instructions: Select one for each item to indicate how you feel.

1 = Strongly Disagree 2 = Disagree 3 = Somewhat disagree 4 = Somewhat Agree
5 = Agree 6 = Strongly Agree

1. I am aware that technologies exist but have not used it.	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6☐
2. I am anxious about the prospect of using technology.	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6☐
3. I do not believe I have sufficient expertise to use technology without assistance.	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6☐
4. I am currently learning how to use basic applications.	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6☐
5. I find lesson plans on the Internet.	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6☐
6. I believe it takes more time to do tasks with technology than without.	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6☐
7. I am familiar with a variety of applications and use them frequently.	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6☐
8. I can think of specific tasks in which a computer might be useful.	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6☐
9. I regularly use technology for collaboration.	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6☐
10. I regularly use technology for communication.	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6☐
11. I regularly use technology for research.	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6☐

12. I regularly use technology to prepare lessons.	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6☐
13. I regularly use technology to deliver lessons in class.	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6☐
14. I regularly experiment with technology and its application in the classroom.	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6☐
15. I would find it difficult or impossible to teach students without the use of technology.	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6☐
16. I design and implement new environments for learning where technology is used by the students.	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6☐
17. I encourage students to use technology in the classroom.	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6☐
18. I share my knowledge of computers and related technologies with other teachers.	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6☐
19. I encourage students and co-workers to experiment with different software and technologies.	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6☐
20. I use a computer program for student grades.	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6☐

Part D: Student Use

Instructions: select one for each item to indicate how you feel.

1 = Strongly Disagree 2 = Disagree 3 = Somewhat disagree 4 = Somewhat Agree
5 = Agree 6 = Strongly Agree

1. My student use ***drill and practice programs*** (i.e. educational software that engages students in multiple choice, true and false, or "worksheet" type of questions) on a regular basis as part of the curriculum.	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6☐
2. My students use ***basic authoring applications*** such as word processors, Excel, Inspiration, and drawing programs on a regular basis as part of the curriculum.	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6☐
3. My students use ***advanced authoring applications*** such as web publishing software, presentation software (i.e. PowerPoint) and/or collaborative groupware on a regular basis as part of the curriculum.	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6☐
4. My students use ***CD-ROM research resources*** (i.e. CD ROM encyclopedias) on a regular basis as part of the curriculum.	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6☐
5. My students use the ***World Wide Web*** on a regular basis as part of the curriculum.	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6☐
6. My students make use of ***networked communications*** (i.e. e-mail bulletin boards, list serves, etc. to contact resources outside the classroom) on a regular basis as part of the curriculum.	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6☐
7. My students computer use is irregular and individual (i.e. computers are in the library and labs)	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6☐

1 = Strongly Disagree 2 = Disagree 3 = Somewhat disagree 4 = Somewhat Agree
5 = Agree 6 = Strongly Agree

8. My students computer use is regular individual use for some students (i.e. as a reward for students who completed in-classroom work)	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6☐
9. My student computer use is irregular group use for short collaborative activities.	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6☐
10. My student's computer use is regular group use for collaborative activities.	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6☐
11. I require students to use technology to complete assignments.	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6☐
12. My students use a digital camera for assignments.	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6☐
13. My students use laptop computers for assignments.	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6☐

Part E: Computers in your Classroom

1. What is your current classroom student-to-computer ratio?

☐ No computer in classroom ☐ Greater than 25:1 ☐ Between 25:1 and 10:1
☐ Between 9:1 and 5:1 ☐ Lower than 5:1

2. What percent of your classroom computer (s) are connected to the Internet?

☐ No Internet access in my classroom
☐ Internet access for all computer in my classroom
☐ Less than 50% of computers are connected to the Internet
☐ More than 50% of classrooms are connected to the Internet

Part F: Computers Training

Have you ever taken any computer training sessions?
Yes: ____ No: ____ If YES, what were those courses?

_____

_____

_____

_____

_____

Have you ever been required to use technology in your teacher credential program?
Yes: ____ No: ____ If YES, what are those courses?

_____

_____

_____

_____

_____

Thank you for taking time to complete this survey. If you have any other comments related to technology integration, please add additional comments on the back of this page.

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